Popular Astronomy.

Vol. XXII, No. 8. OCTOBER, 1914. Whole No. 218

MAN'S PLACE IN THE UNIVERSE.

HECTOR MACPHERSON Jr., M.A., F.R.A.S.

The great theory of evolution, as applied to the organic world by Darwin, Wallace and Spencer among others, profoundly affected man's estimate of his relative importance in the scheme of things. Man is no longer looked upon as something apart from and distinct from the rest of nature. He is part and parcel of the natural world.

While this is so, he is something more than natural. Between the most intelligent ape and the average human being, there is a great gulf fixed. In the words of Professor Arthur Thomson—"Every one now admits that the distinctiveness of man from his nearest allies depends not on anatomical peculiarities, important as they are, but on his powers, especially on his powers of rational discourse, of building up general ideas and of guiding his conduct by ideals." Man remains then the crown of creation; while part of nature, he is a great deal more. The evolution theory may have entered our conception of the origin of humanity; it cannot enter our sense of the infinite worth and dignity of man.

Man, then, remains the chief object of creation—despite the revolutionary scientific conceptions of the past century—so far as the earth is concerned. But the earth is only one tiny planet surrounding a rather insignificant star. There are many other planets in the solar system; and in the stellar system, there are hundreds of millions of stars, many of which are in all probability the centres of systems of planets. What of these planets? Are they like our world, the abode of life? Or is our dwelling place the only globe in the universe on which intelligent life exists?

The question of the plurality of worlds is a very old one. Acute thinkers, such as Bruno and Huyghens, saw clearly that the doctrine of a plurality of worlds was to be logically deduced from the Copernican theory of the planetary motions. Under the Ptolemaic system, the

earth was stationary—fixed and immovable at the centre of creation. Once admit, as Copernicus and his disciples did, that the earth is in revolution round the sun, and the logical deduction is that the earth is merely one planet among others and that therefore, if the earth is inhabited, there is no reason why other planets should not also be abodes of intelligent life. Belief in the plurality of inhabited worlds was one of the charges brought against Bruno in 1600. Towards the end of the seventeenth century (1686) Fontenelle, secretary of the French Academy of Sciences, issued a book on the subject, concluding that the moon and planets are inhabited and that the fixed stars are centres of planetary systems. A few years later Huyghens, the Dutch mathematician, published his famous *Cosmotheoros*, in which he deduced by analogy a number of opinions concerning the vegetable, animal and intelligent life in the planets. According to Brewster, Kepler and Tycho at an earlier stage, both supported the view that the planets were habitable.

As astronomical discovery progressed, men of science became more and more inclined to belief in a plurality of worlds. In his "Astronomy explained upon Sir Isaac Newton's Principles," Ferguson remarked that "to an attentive observer, it will appear highly probable that the planets of our system, together with their attendants called satellites or moons, are much of the same nature with our earth and are destined for like purposes; for they are solid opaque globes, capable of supporting animals and vegetables". The fixed stars too, he believed, "are made for the same purposes that the sun is, each to bestow light, heat, and vegetation, on a certain number of inhabited planets."

The doctrine became increasingly popular when the elder Herschel lent to it the great weight of his authority. Herschel was an enthusiastic supporter of the doctrine; indeed, he carried it a stage further. By adopting and developing the theory of the sun put forward by Alexander Wilson, Professor of Astronomy at Glasgow, he was led to the view that the sun and fixed stars might all be inhabited. He regarded the sun as a cool and dark body surrounded by a very extensive atmosphere. Below the outer envelope of fiery heat—the photosphere—lay dense and opaque clouds; and below these again lay the solid globe of the sun, sheltered from the fierce glare of its own outer envelopes. "The sun, viewed in this light" he wrote in 1794 in a paper "On the nature and construction of the Sun and Fixed Stars", "appears to be nothing else than a very eminent, large, and lurid planet." "It is most probably inhabited, like the rest of the planets, by beings whose organs are adapted to the peculiar circumstances of that vast globe." In the same paper, curiously enough, he discussed the moon and reached the conclusion that our satellite also was necessarily the abode of

intelligent life. Proceeding to the fixed stars, he pointed out their analogy to the sun. Not only were these suns the centres of planetary systems and sources of light and heat; but they were also, like the sun, in reality solid globes surrounded by fiery outer envelopes and in all probability the dwelling places of myriads of inhabitants.

The late Miss Clerke has pertinently remarked that "the philosophers of that age regarded the multiplicity of inhabited worlds as of axiomatic certainty. The widest possible diffusion of life followed, they held as a corollary from the beneficence of the Creator; while their sense of economy rendered them intolerant of wasted globes." It may also be said that the eighteenth century philosophers and astronomers regarded only the present. The evolutionary conception was foreign to them. If the planets were habitable, they must be so now. It is rather remarkable that a man like Herschel—himself one of the pioneers of evolution—did not realize the hollowness of this line of argument. If he did, he has not recorded the fact. Had he developed his complete scheme of evolution earlier in his career, he would almost certainly have been led to the abandonment both of his theory of the sun as a solid globe, and his assumption of the simultaneous existence of intelligent beings on all the worlds.

The influence of Herschel in a greater or less degree, is to be traced in the writings of Chalmers, Dick, Arago and Brewster. The discussion entered a new phase when Dr. Whewell published in 1853 his book entitled "The Plurality of Worlds; an Essay." The old note of certainty was gone. Whewell was led to the conclusion that some of the planets were certainly not habitable and others probably not so. Starting from the evident fact that there is no animal life on the moon, he argued from analogy, that if the moon is uninhabited in spite of its favorable position in regard to the sun, other planets may be also uninhabited. Whewell examined the planets one by one and, whatever we may think of his arguments respecting each of the planets, there can be no doubt that his discussion was much more thorough than that of previous investigators.

He also referred to the religious difficulties connected with the doctrine. It is, he said, difficult for a religious man to reply to the contention of the sceptic that, if the other planets are inhabited, we can scarcely conceive of the Creator taking so particular an interest in man as to send His Son to die for the sins of one insignificant race on an insignificant planet. While maintaining an agnostic position on the question of habitability, Whewell obviously inclined to the view that the earth was unique. "If" he wrote "man be not merely capable of virtue and duty, of universal love and self-devotion, but be also immortal, if his being be of infinite duration, his soul created never to die; then indeed

we may say that one soul outweighs the whole unintelligent creation."

Whewell's essay called forth a spirited reply from the distinguished Scottish physicist, Sir David Brewster. On the whole, Brewster held to Herschel's general conception—accepting even the Herschelian theory of the opaque nature of the solar globe. In his chapter on the "sun and the satellites," Brewster simply reproduced Herschel's line of reasoning, quoting the great astronomer at length, and reinforcing him by a large number of *a priori* arguments. In regard to the sun, for instance, he says, "it is difficult to believe that a globe of such magnificence, upwards of one hundred times the size of our earth, should occupy so distinguished a place without intelligent beings to study and admire the grand arrangements which exist around them." "Kingdoms without kings and subjects, continents without cities, houses without families, ships without crews, and railway trains without passengers, are contingencies as probable as solar systems without planets or planets without inhabitants." Despite Brewster's earnestness and conviction, his book unfortunately bears the stamp of a piece of special pleading. On one point, however, his line of reasoning is superior to Whewell's. Discussing the religious objections, which Whewell discussed and appeared to support, Brewster asked—"Is it conceivable that a Theist or a Christian of the smallest mental capacity could suppose that there are degrees of omnipotence and imagine that the Almighty might be prevented by the many worlds under his management, from taking care of the earth and its inhabitants?"

By the time of the publication of the next important work on the subject the whole situation had changed. Proctor's "Other Worlds than Ours" (1870) was a typically nineteenth-century production. In place of the *a priori* arguments of Brewster, we find appeals to observation and careful discussion of the circumstances of each particular planet. Evolution, too, was in the air and men of science realized that the various worlds of the solar system might be at different stages of existence.

In 1865 Zöllner, the German astronomer, remarked that the rapid changes in the cloud belts of Jupiter and Saturn indicated a high internal temperature. These clouds, he pointed out, were certainly not due to sun-heat, owing to the great distances of the planets from the sun. Proctor accordingly was not slow to point out that the high internal temperature of these planets precluded their habitability. He was careful to show, however, that the existence of inhabitants was only precluded "for the present." Saturn, Uranus and Neptune were also ruled out on the same grounds. He held that Venus and Mars were probably inhabited. Indeed, he designated the latter planet "the miniature of our earth," believing in the existence of continents, oceans,

clouds and snow, on the surface of that globe. In regard to the stars, Proctor held the generally accepted position—"It seems reasonable to conclude that these suns are girt round by dependent systems of worlds."

The whole question of the plurality of worlds has been removed, within the last twenty years, from the region of the abstract to that of the concrete. From theoretical discussions and argument from analogy men have come to discuss the physical conditions of particular planets.

To the late distinguished Italian astronomer, Schiaparelli of Milan, we owe the systematic study of the three inner planets, Mercury, Venus and Mars, which are, with the single exception of the moon, our nearest neighbors in space. In the case of Mercury, Schiaparelli's observations from 1882 to 1889 showed that that little planet rotates on its axis in the same period in which it revolves round the sun. As a result, one side of the planet has everlasting day and the other perpetual night. In consequence of the libratory motion of the planet—the result of uniform motion on its axis and irregular motion on its orbit—the sun rises and sets over a small zone of the planet's surface, which, it was suggested by the late Mr. Gore, might be inhabited by some forms of life. On the whole, however, it is very unlikely that Mercury is an inhabited world.

Schiaparelli's study of Venus revealed a similar fact—the coincidence of the times of rotation and revolution. It is true that his conclusion was stoutly contested and that even yet it is denied by some eminent authorities, such as Professor See, chiefly however on *a priori* grounds. On a first consideration, it seems unlikely that Venus is inhabited; but, on the whole, we know too little of the planet's atmospheric and and general physical condition to reach a definite conclusion on the subject.

Schiaparelli's observations on Mars—which extended from 1877 to 1890—gave rise to one of the most heated scientific controversies of recent years. In the autumn of 1877, while executing a trigonometrical survey of the disk of Mars, Schiaparelli was astonished to find that the reddish-ochre portions—known as the "continents"—were traversed by a number of straight dark lines. To these he gave the name of *canali*, an Italian word which may be translated as "channels" or "canals." In 1879 he discovered that some of the canals had become double and in 1881 he detected a number of new canals. During these years, he was the only observer who succeeded in observing the canals. He worked alone; and despite his great reputation as one of the keenest observers of the age, he worked in spite of the scepticism and derision of the whole scientific world. The sneers and scoffs of the scientists of his day remind us of the bitter attack on Galileo. The only difference, however, was that the men who ridiculed Galileo were, professedly

at least, actuated by religious motives. Those, on the other hand, who attacked the discoveries of the Milan astronomer did so as a result of scientific conservatism.

At length in 1886 the canals were observed by Perrotin and Thollon, astronomers at the Nice observatory. After this they were observed by a number of the most distinguished astronomers in Europe and America. In 1892 W. H. Pickering, observing in the fine climate of Arequipa, on the slope of the Andes in Peru, detected at the junction of the canals dark spots which he termed lakes.

In 1890 failing sight compelled Schiaparelli to abandon observations on Mars; and in 1894 Mr. Percival Lowell erected a private observatory at Flagstaff, Arizona, for the special purpose of observing Mars. During the first months of his study he mapped three hundred and fifty canals. A season's observation convinced him of the reality of the canal-system, and in the end of 1895 in his book "Mars" he sumarized the results of his investigations and put forward his theory of the planet.

With no uncertain voice, he declared that the canals were real phenomena of the planet's surface. His observations revealed the fact that both single and double canals and the round spots at the canal junctions known as oases are subject to seasonal change; and that the whole canal system is dependent on the melting of the polar cap. Lowell declared that the lines which we call the canals are not the canals themselves but the strips of fertilized ground surrounding them. As the cap melts, the canals become darker; indeed, a wave of verdure passes from the poles down to the equator and into the opposite hemisphere. The canal system, he holds, is the work of the inhabitants of Mars; the planet is relatively much older than the earth and, as much of its surface appears to be desert land, it suffers from scarcity of water. To remedy this, the inhabitants have constructed the system of canals to convey the water from the melting polar cap, and have made their abode in the various "oases" which are believed by Lowell to be centres of population, where the inhabitants, driven from the desert land by scarcity of water, cluster about the ground artificially fertilized."

This amazing theory—for amazing it certainly seemed—met with a hostile reception; and for a number of years, the scientific world inclined to an hypothesis put forward by the Italian astronomer Cerulli, of Teramo. This theory was to the effect, as the late Simon Newcomb—its most distinguished supporter—put it, that the "canaliform" appearance "is not to be regarded as a pure illusion on the one hand or an exact representation of objects on the other. It grows out of the spontaneous action of the eye in shaping slight and irregular combinations of light and shade, too minute to be separately made out into regular

forms." In 1905, however, several photographs of Mars were secured at the Lowell Observatory and in several of these the canals are shown as straight dark lines. In the following years, more distinct representations were secured.

The canals then exist, but is Lowell's theory placed beyond doubt? During twenty years, in a superb climate, with magnificent instruments, the American astronomer has collected an enormous mass of information which has further confirmed his theory; and in his later books he has further developed his views. As the result of his long and sustained study of Mars, he is entitled to speak with an authority which cannot be claimed for his critics. Must we then accept his dictum that "what we see hints at the existence of beings who are in advance of, not behind, us in the journey of life?" At present we can only say that the "balance of evidence" is on the side of the theory; but in all probability, it can never be anything more than a theory, which may or may not be still further confirmed as investigation progresses.

The Martian controversy has been discussed at length because of the fact that here we have the question of the plurality of worlds reduced to one particular case. Whether or not Mars is inhabited at the present time does not settle the general question.

Within the past decade the two extreme positions have been well stated by able apologists. The late Dr. Alfred Russel Wallace published in 1903 his book "Man's Place in the Universe." In this book, Wallace claimed "enormous probability for three conclusions:" (1) "that no other planet in the solar system than our earth is inhabited or habitable." (2) "That the probabilities are almost as great against any other sun possessing inhabited planets." (3) "That the nearly central position of our sun is probably a permanent one, and has been specially favorable, perhaps absolutely essential, to life development on the earth." Undoubtedly the book was a remarkable production, but it failed to make much impression. The whole theory is based on very inadequate evidence. Indeed the volume, like Sir David Brewster's fifty years earlier, is simply a case of "special pleading;" and one cannot but feel regret that Wallace, in his old age, should have issued a book the main argument of which is so easily refuted.

More recently Professors Arrhenius and See have combined with their cosmogonic speculations the assertion of the universality of life. Arrhenius, after discussing the theories of Richter and of Lord Kelvin that life may have come to the earth from without, puts forward his doctrine of panspermia. Starting from his underlying assumption—the reality of the "radiation pressure" he says "It is very probable that there are organisms so small that the radiation pressure of a sun would push them out into space, where they might give

rise to life on planets, provided they met with favourable conditions for their development." Granting the truth of this assumption of Arrhenius, life is universal and eternal, and is a necessary adjunct of matter itself. All organic beings in the Universe are related to each other. Life on other inhabited planets has probably developed along lines which are closely related to those of our earth." It is a great generalization, but whether or not it is actually true, —whether life is actually carried from star to star in this way—is probably beyond the reach of human knowledge.

See, whose Theism is in contrast to the Monism of Arrhenius, holds that "in view of the established uniformity of nature's processes throughout the immensity of space, who can doubt that life is a general phenomenon ordained by the Deity from the creation of the world and destined to develop wherever planets are forming and the stars are shining? Whatever be the nature of life, it has as much right to develop as planetary systems or combinations of atoms; it is indeed the bloom of nature, the culmination of the highest creative forces." Similar views have been expressed for many years past by Flammarion. "The forces of nature" says the eloquent Frenchman "have life as their supreme end. Life is universal and eternal, for time is one of its factors. In space there are both cradles and tombs."

Whatever we may think of the generalizations of Arrhenius or the arguments of Lowell in favour of the habitability of a particular planet, there can be no doubt that analogy, reason and investigation are on the side of a doctrine of the plurality of worlds as against Wallace's hypothesis. But a tenable doctrine of plurality must differ in several important characteristics from that of a century ago. In the first place, the general conception of evolution has obviated the necessity of believing that all the habitable worlds in the Universe are simultaneously abodes of life. Some worlds are dead; others are in preparation. In the second place, both scientific and religious considerations lead us to the conclusion that life, if it exists on other worlds, must be, generally speaking, akin to life on our own planet. Some bodies in the universe will probably be ever unsuitable to be the abode of life.

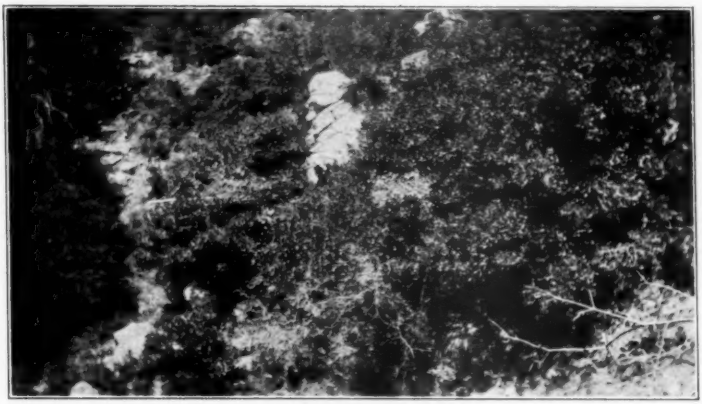
A doctrine of the plurality of worlds is the fitting corollary to the Copernican and Darwinian revolutions in our cosmological conception. Copernicus showed that man's position in nature was not unique, that his dwelling-place the earth was but one among many; Darwin pointed out that man's origin from the physical side was not unique; the doctrine of the plurality of worlds teaches us that humanity itself is not a unique phenomenon in the Universe.

NOTES ON A VISIT TO MOUNT WILSON.

LEO HOLCOMB.

I thought the accompanying snapshot pictures might be of some interest to readers of POPULAR ASTRONOMY.

"Old Man Rock" as this very unique and massive stone is called, is very near the summit of Mt. Wilson, near the center and at the head of the great canyon overlooking the beautiful cities of Pasadena, Los



OLD MAN ROCK.

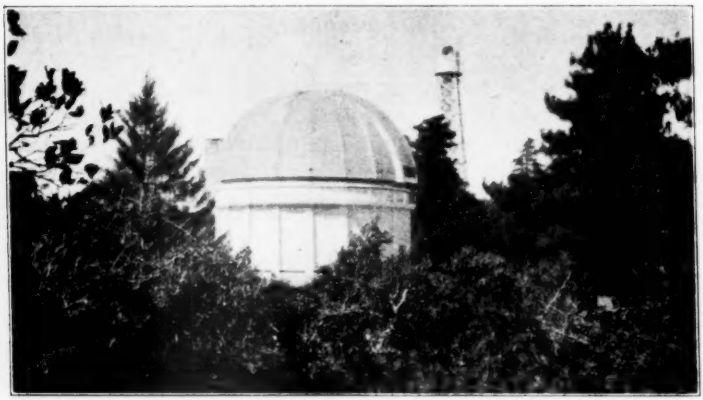
Angeles and out to the sea. He has stood grim and silent for centuries, no doubt, as though it were his duty to keep watch over the activities of men as they come and go in the great valley beneath.

The observatory in which the great sixty-inch reflector is housed is shown in another picture, also the two wonderful tower telescopes, used exclusively for work on the sun. Still another shows the beginning of the foundation where will be mounted the largest telescope in the world, the famous one-hundred-inch glass.

I had the pleasure of being shown this glass by Professor Ritchey while it is in the process of being worked and tested in the optical shops at Pasadena.

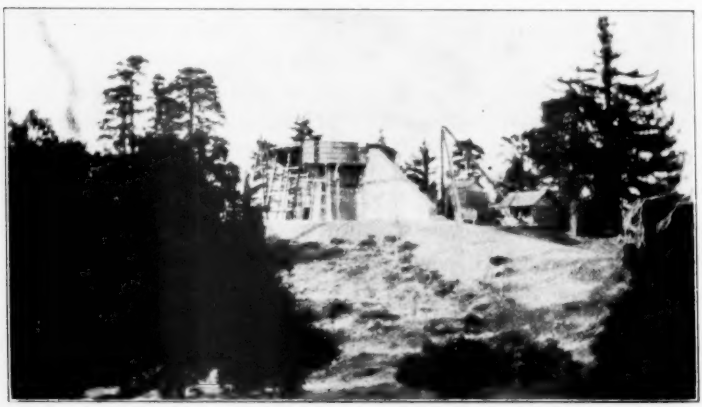
Another very interesting spot is the old Harvard Observatory site, which is only a short way from the present Mt. Wilson Observatory.

The memorial tablet shown here bears an inscription indicating that the observatory was established in 1889. To the left of the picture may be seen a low bench. People from all over the world have no doubt occupied this bench and sat in raptures in beholding the wonderful and



THE DOME FOR THE SIXTY-INCH REFLECTOR.

magnificent view of the valley and ocean beyond, and at night the beautifully lighted cities of Pasadena, Los Angeles and beach towns, miles in the distance. This point is six thousand feet above the sea with Pasadena nestling close to its base and Los Angeles only ten miles to the south. You may imagine what a picture this would make.



FOUNDATION FOR THE 100-INCH REFLECTOR.

I spent a year and a half in southern California, living in Pasadena, probably the most beautiful city in the United States. The wonderful climate of this part of the state cannot be appreciated until one has spent at least a year there.

THE OLD HARVARD OBSERVATORY SITE.

I do not hesitate to say that the Mt. Wilson Solar Observatory site is the most magnificent, from a scenic point of view as well as being the most favorably situated in atmospheric conditions, of any observatory in the world.

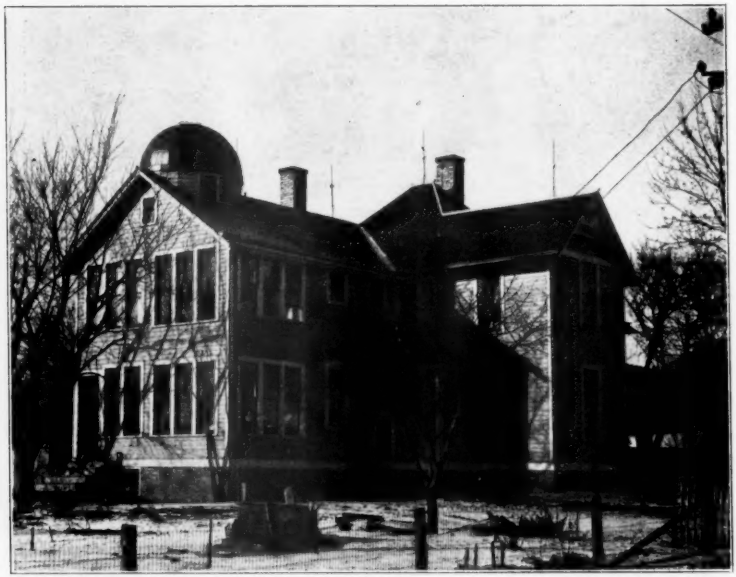
I had the pleasure of hearing Professor G. E. Hale give a lecture in Pasadena on "The Sun as a Magnet", and of meeting Mr. Walter S. Adams, assistant director of the observatory, and Professor Ritchey who is known the world over wherever astronomy is known; also Professor Ellerman and Mr. Pease of the optical laboratories and Mr. Campbell, a very courteous gentlemen who is employed on the mountain and who was kind enough to show and explain to me the various things of interest to be found there.

Decatur, Ill.

BUILDING AN AMATEUR'S OBSERVATORY.

CHAS. L. EARLY.

Last summer I remodeled my house to some extent and found that I had an opportunity to construct an observatory for my four inch telescope, that I had been troubled with for some years, handling it on a tripod, (that sized glass being too large to handle easily on a tripod.) So I proceeded to the task of building an observatory on the rear part of



MR. EARLY'S HOUSE AND OBSERVATORY.

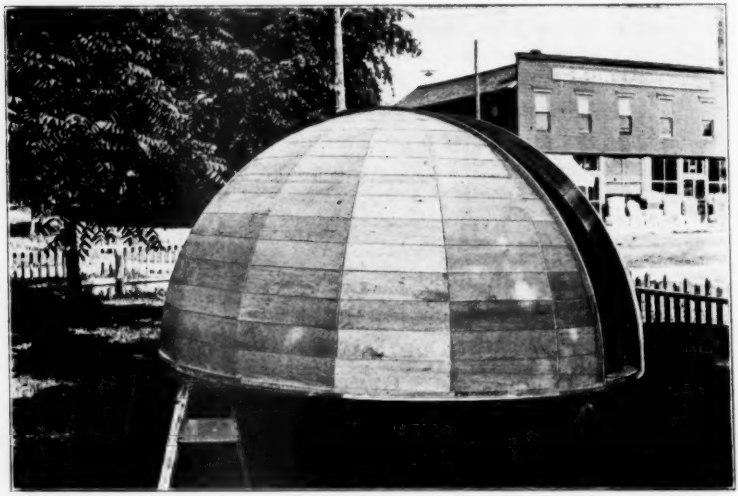
the house, where I was putting up a closed-in porch eight feet wide, and making the observatory eight feet in diameter, which is a nice size for a four inch glass. It being eight feet in the clear would accomodate a five inch glass. I find the glass works very satisfactorily, there being but little vibration under ordinary conditions. The joists on which the pedestal for the glass is attached are made of 2x6, while the floor joists are 2x8, and are so arranged that neither the floor of the observatory nor the ceiling of the room below touch these supports, their only

bearings being at the ends of the eight foot joists to the solid studding that run down to the solid foundation, so the vibration caused by walking on the floor of the observatory has but little effect on the glass. Now the building of such an observatory would not be much of a task if one had a good mechanic who knew just what was wanted, or if one had plans and specifications furnished ready to begin with, but to start in with neither of these, as I did, I found I was up against quite an undertaking, and was compelled to direct every move from start to finish. I am inclosing photographs of the dome as it appeared when ready for tinning, constructed of white pine, ¾-inch, sawed on a four foot radius, laminated and nailed together for the ribs and the base, and covered with ½-inch white pine ceiling. The two ribs on which

FRONT VIEW OF THE DOME READY FOR TINNING.

the shutters slide are four inches wide, while the other ribs are only 2½ inches wide. The shutter is made in three sections, which makes it much easier to handle than it would be all in one piece. The shutter is handled by a system of pulleys and cords, the shutters being of galvanized iron, shaped and flanged so as to run on the two four-inch ribs which extend from one side of the dome to the other, parallel and separated by about 16 inches. All other ribs butt against these at their natural junctions. The dome might be covered with cheaper material, but I wanted to make it quite permanent, so I had it covered with the best tin I could procure. I feel confident it will last as long as the other parts of the

house, and besides the tin strengthens the dome materially; otherwise it might be preferable to construct the skeleton dome of stronger wood than the soft pine used in this case. The dome was tinned and completed before putting upon the base on the roof of the house.



SIDE VIEW OF THE DOME READY FOR TINNING.

My greatest trouble was in getting a suitable track and trucks for revolving the dome. I sent to an hay-track factory and had the track bent to the proper radius, and had the same factory furnish me the small wheels which they use on their hay carriers, I had the pin holes filled with babbitt metal and new holes bored to fit pins about ¼-inch, and fitted these wheels into trucks made by bending strap iron, about 3 inches wide by ¼ inch thick, into U shape, using two wheels for each truck, and using three sets of trucks. It works quite satisfactorily since finished. I also send you two views of the house after the job was completed to show how it appears both from the rear and front of the house.

I do but little practical work with my equipment, but take great satisfaction in observing many of the interesting beauties and wonders that are to be seen with a four-inch glass, and giving my neighbors and young friends an opportunity to become acquainted with some of the really great and wonderful things of creation, which they might have never come in contact with if I had not made it convenient for them to do so. The satisfaction I obtain by the exclamations of delight from the young people when they take their first look at the moon, or Jupiter,

with his four little moons, or Saturn, or some star cluster or some of the beautiful double stars or nebulae, repays me well for the expense and trouble I have been put to in constructing and equipping this little playhouse for my old age. I feel that I have done a noble deed when I have been the means of inducing any person to take an interest in any astronomical matter. I feel that he can not fail to receive some benefit from it, his mind broadened, his soul uplifted.

My telescope is made by Wm. Gaertner & Co., of Chicago, Ill.; 4-inch glass, equatorially mounted with driving clock device, same as advertised on your last cover page. Instead of the tripod I had a head block cast and placed this on top of a wooden pedestal in the center of the observatory, and placed the telescope on this pedestal permanently.

Such an observatory may be constructed on any roof without damaging the building and with but little expense aside from the dome, which probably would cost under ordinary conditions from $100 to $200.

I have omitted much of detail in this description, but will be pleased to furnish further details to interested parties.

Sac City, Iowa.

THE SO-CALLED RING NEBULA IN LYRA.

CHARLES NEVERS HOLMES.

Amid the zenith splendor of the bespangled sky, when mid-summer's dog-days reign over land and sea, blue beautiful Vega scintillates like a sidereal diamond of first-magnitude, while, close by, Beta and Gamma of the same constellation Lyra sparkle less conspicuously. Blue beautiful Vega is spectacularly visible even to not very keen eyesight, and Beta and Gamma are also visible; but the remarkable nebula between Sheliak and Sulaphat—the so-called "ring nebula" in Lyra—is wholly invisible without the assistance of the telescope.

Upon the surface of the starry firmament, so to speak, there are many wonderful astronomical spectacles, but that firmamental surface —what we see at a casual glance—exhibits merely a suggestion of the stellar marvels and mysteries that lie hidden beneath that surface. Below the ebony blackness of that firmamental surface the unassisted eye of man cannot penetrate, and the telescope alone can reveal myriads of suns and numerous nebulae. One of the most remarkable of the numerous nebulae so far discovered does not require a very strong

telescope to bring it to view. The firmamental position of this somewhat circular nebula is in a line from Beta to Gamma Lyrae, and the nebula will be recognized by its ring-like or annular form, the center apparently being dark and containing a star which is known as the "central star". The outer or ring part of this nebula exhibits different degrees of brightness and it has been suggested that this ring is made up of several overlapping rings. However this is, the usual photographic representation of this nebula in Lyra exhibits an annular outline which is not a true circle but more of an oblong shape. One side of this oblong ring has a fairly regular curve, but the other side has a somewhat ragged and irregular edge. The ends of this annular nebula come to a sort of point, and the whole effect to the eye is not exactly ring-like, although for the sake of description it may popularly be called so.

Sir John Herschel describes this annular nebula in this way. "It is small and particularly well defined, so as to have more the appearance of a flat oval solid ring than of a nebula. The axes of the ellipse are to each other in the proportion of about 4 to 5, and the opening occupies about half, or rather more than half, the diameter. The central vacuity is not quite dark, but is filled in with faint nebula like a gauze stretched over a hoop."

On an ordinary exposure of a photographic plate, the outlines of a ring nebula are developed; but, in case the plate is exposed for a longer time, the "central vacuity" becomes all filled up, and a complete disk-nebula results. Thus, in a way, the ring-like appearance of the nebula is only half the truth—it may be that the nebula is a hollow shell of gas, its border being brighter to man's terrestrial eyes owing to his looking through in this border a larger amount of the shining matter constituting the nebula. Respecting this shining matter there has, of course, been a great deal of discussion, and it seems as though it is a sort of self-luminous gas. Regarding its distance even less is known; but probably all nebulae are situated at remotenesses approximating those of the telescopic suns. Also, respecting its size little is known; but it has been estimated that, were our whole solar system placed in the center of this ring nebula, that solar system would occupy no more apparent space than that exhibited by the "central sun" on the photographic plate. Since the moving diameter of our solar system approximates 6,000,000,000 miles, of which our tiny earth occupies some 7912 miles, one may get a vague idea of the vast size of the nebula as well as its immense remoteness from him.

As might be expected from gaseous and semi-gaseous bodies, the numerous nebulae in our Universe present to the eye of man's telescope all kinds of shapes and conditions, as the nebulae of the "dumb-bell",

of the Pleiades, of Argo, of Orion, Andromeda and of Canes Venatici. Of the many nebulae, there are only a few examples of the ringed nebula, the one here described being easily the most remarkable. Of course, the photographic plate is likely at any time to develop the discovery of another ring nebula, and at present the constellations of Scorpio and Cygnus possess respectively two and one of such nebulae. The remoteness of nebulae and the difficulty of studying them even with twentieth-century telescopes and photographic plates have hindered greatly scientific and popular knowledge respecting these "spectres" of our Universe; but time and advance in astronomical invention and information will reveal more and more, and surprising and wonderful discoveries concerning them may be expected sooner or later.

Dover, N. H.
147 Locust St.

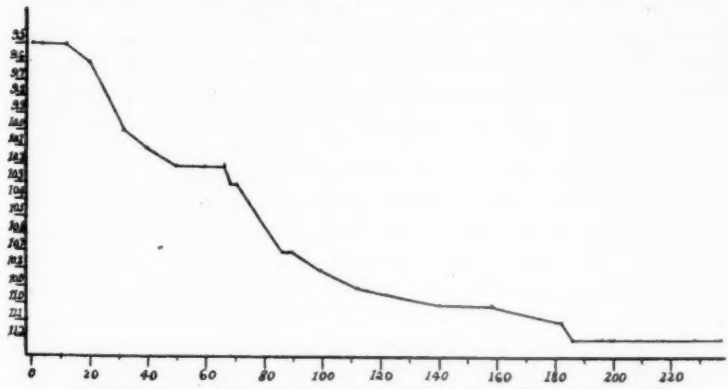
OBSERVATIONS OF NOVA (2) GEMINORUM, 1913-14.

FREDERICK C. LEONARD.

This paper contains the results of all of my observations of the Nova (2) Geminorum (1900.0 α 6^h 48^m $25^s.0$, δ + 32° 16′.0) obtained during the recent apparition of 1913-14. It is therefore a continuation of my work on the star published in POPULAR ASTRONOMY, the last installment of which appeared in the August and September, 1913, issue, XXI, 7, pp. 437-438. That concluded the set of observations made in the season of 1912-13. The instrument employed throughout the present series has been my 4-inch equatorial refractor (optical parts by Petit-didier, mechanical by Gaertner). A tabulated form of the substance of these observations is given below.

Date	Mag.	Color	Notes
1913, Aug. 27	9.5	Light bluish green	A.M. observation
Aug. 30	9.5	Very pale bluish white	" "
Sept. 7	9.5	" " " "	" "
Sept. 15	9.6	" light " "	" "
Sept. 27	10.0	" " " "	" "
Oct. 5	10.1	" pale " "	" "
Oct. 15	10.2	" " " "	" "
Oct. 25	10.2	" " " "	P.M. observations after 1913, Oct. 15
Nov. 1	10.2	" " " "	
Nov. 3	10.3	" " " "	
Nov. 5	10.3	" " " "	
Nov. 21	10.7	" " " "	
Nov. 23	10.7	" " " "	
Nov. 24	10.7	" " " "	
Dec. 4	10.8	" " " "	
Dec. 17	10.9	" " " "	
1914, Jan. 14	11.0	Too faint for color after 1913, Dec. 17	
Feb. 1	11.0		
Feb. 25	11.1		
Mar. 1	11.2		
Mar. 11	11.2		
Mar. 14	11.2		Star very easily seen
Mar. 15	11.2		Sky very bright
Apr. 12	11.2		
Apr. 21	11.2		Sky bright; star rather difficult to see

The comparison stars used in determining the foregoing estimates have been those whose magnitudes are furnished on the Harvard College Observatory photometric chart of the region of the Nova. The dates of the morning observations are all the civil, not the astronomical dates. As implied in the table, due to the faintness of the Nova, color determinations, after 1913, December 17, were, with a telescope of 4 inches aperture, quite impossible. When it was visible in the morning sky, the star was observed on the average of once a week. Afterward, during the early part of the time it was accessible in the evening, it was estimated more frequently, but subsequent observations are deplorably few in number on account of the excessively unpropitious weather that prevailed here throughout almost all of the late fall and winter months. After 1914, April 21, its position was so low, and it was consequently so immersed in the glare of twilight and of the city, when it was above the horizon, that, combined with its exceeding faintness, the Nova was often hardly visible. Thus observations of it then were not feasible, as they obviously could not be expected to be obtained, under such conditions, with any reliability or precision. It was therefore desirable, and really necessary, to discontinue estimates after April 21. The result is that only 25 observations were gotten in the course of this appearance.



LIGHT CURVE OF NOVA (2) GEMINORUM, 1913, AUGUST 27-1914, APRIL 21.

Accompanying is a light curve of the Nova for this period. The vertical scale gives the magnitude, and the horizontal the number of days—237 in all—during which the star was under observation. This shows the gradual yet constant decrease in brightness which it evinced after it again became visible, in the morning sky, on 1913, August 27. On that date it was at the 9.5 magnitude, or a whole half of a magnitude fainter than when I last saw it in the evening sky, on June 10, for at that time it was of magnitude 9.0*. The star had therefore dropped appreciably during the ten weeks or more it was invisible in the sun's rays. And from August 27 to December 17, its descent was *comparatively* rapid, because on the latter night it was of magnitude 10.9—this being equivalent to a drop of 1.4 magnitudes in 112 days. Following December 17, the Nova waned slowly, and apparently became stationary, on 1914, March 1, when it had reached the 11.2 magnitude. From then to the end of this set, April 21, it obviously seemed to remain of that brilliancy. Its total extent of decrease was therefore 1.7 magnitudes in 186 days (1913, August 27—1914, March 1).

The most remarkable feature of this decline is that it was so constant and uninterrupted. Not once did the star fluctuate or brighten up; not once was it detected to manifest the slightest indications of a gentle rise. Indeed, subsequent to 1913, November 21, frequent observations were fortunately not required, as often estimates made at intervals of three weeks or one month did not reveal a change of more than 0.1 of a magnitude in the star's light; this fact is clearly brought out by a hasty inspection of the table or the light curve.

* *P. A.*, XXI, 7, pp. 437-438.

Just as they have always been of such prime interest and so fruitful in the case of the Nova, so have the observations of its color continued to be;—that is, as long as they were within the capacity of my instrument. On the first date of this series, the star was again discovered to be of a light bluish green tinge*,—the same as that with which I left it on 1913, June 10†. By August 30, it seemed to have faded out to a very pale bluish white, and from then through December 17, after which its hue was no longer distinguishable, it appeared to be of practically that delicate tint‡. In my estimations of the colors of double stars, several years ago, from which I developed my double-star color induction and which were published in the *English Mechanic*, "very pale bluish white" was the term that I applied to a bluish star that could barely be discriminated from a genuinely pure white; in other words, it was the closest possible shade to a real white which I could appreciate. I mention this merely to illustrate that the Nova has so nearly approached a white that its hue—if any—has been only the slightest possible grade above white.

The chromatic changes of Nova (2) Geminorum have, to me, been almost as interesting as its variations in magnitude. Perhaps a hasty review of their history will be profitable as well as interesting. When the star was at its very brightest, *i.e.*, at the time immediately following its discovery, and until 1912, March 19 (a week later), it was very pale yellow¶—nearly resembling in its color the beautiful star Capella. On March 19, I observed what was probably its first alteration. It had then declined to the 5.5 magnitude, but it was now very slightly pinkish. Unmistakably pinkish it was till it experienced its first and greatest rise, March 22-24, when it had brightened up to magnitude 4.8,—a jump of 0.8 magnitude in approximately 48 hours,—and when it was again witnessed as creamy white. Three days later, or by March 27, the light curve afterward plotted of it‖ illustrates that it

* As explained beyond, this greenish effect might have been due largely to moonlight. If so, the color on this date was doubtless that of all the succeeding observations,—namely, very pale bluish white.

† *P. A.*, XXI, 7, p. 437.

‡ I am aware of the contention, maintained by some, that all faint stars have a tendency to appear bluish in small telescopes, but I am inclined to believe that the Nova was intrinsically of this shade because it was of very similar hues when it was so bright that its real color was unmistakable.

¶ In this and all similar statements that follow, it will be understood that I am alluding to my own observations, which are contained in these papers and notes in POPULAR ASTRONOMY: XX; pp. 310-313, 379-380, 449-450; XXI; pp. 50-51, 99-100, 168-169, 238, 300, 366-367, 437-438. This will of course not necessitate further individual references to the foregoing sources in question.

‖ See *P.A.*, XX, 5, p. 312.

had once more declined, and, moreover, that it had descended almost as rapidly as it had risen five days previous, since it was then of magnitude 5.9, and light red in tinge. On the following night it was "fiery red," and as it went down in the scale of brightness, it passed through many of the various shades of red finally into a "decidedly deep red,"—a hue closely resembling, or even more intense than, that of *R* Leporis, *R* Leonis or *RV* Cygni,—the depth of its color depending nearly invariably upon its magnitude. By this time it was April 11, and the star was of the 6.7 magnitude.

I repeatedly called attention, in my earlier reports on the Nova, to the fact that its oscillations in brilliancy were regularly attended by relative and corresponding shifts in color. So they were, and to a remarkable degree. It is possible, however, that when the star was fainter, its tinge did not impress the eye as being so intense as when it was bright. This may explain why, *e. g.*, on 1912, June 10, when it was of magnitude 7.7, it was "rather deep red," whereas on April 11, at which time it was a whole magnitude more brilliant, it was "decidedly deep red." On the other hand, this obvious fading in hue may not simply be apparent but real, especially in view of the fact that the Nova was found, when it reappeared in the morning sky on August 31 following, to have lightened in its hue to a pinkish white! The latter explanation is perhaps the correct one, since it is actually far more compatible with observed phenomena, and, should it be, it would indicate that the Nova's maximum depth of color was attained when it was still comparatively at its brightest, and at a period very early in its life history. This seems to me to be the more probable of the two, because it is fully supported by all the succeeding observations. Nevertheless, color is not so perceptible in faint stars as in brighter ones, where the intrinsic intensity is identical in both instances.

But to return to our main theme, we find that on 1912, August 31, when the Nova had sufficiently emerged from the morning twilight again to be visible, and was of the 7.8 magnitude (almost as brilliant as when it disappeared over two and a half months before), it was pinkish white, and that on September 8, it was very light *greenish* white, although, on the latter date, it was precisely of the same brightness as on June 10 (magnitude 7.7)*. Clearly it had undergone an unmistakable and decided change since it passed into the sun's rays a little less than three months previous. On October 19, of magnitude

* It is highly probable that on August 31, the star was very light greenish white, but that it appeared pinkish, due to its location in the dawn. There is no really good reason to believe that it radically altered in hue between August 31 and September 8, as the original determinations would indicate. Color is very difficult to judge accurately on a brightly illumined sky.

7.6, it was very light greenish blue, and it retained this tinge through 1913, January 25, when it was of the 8.4 magnitude. By January 28, it had brightened to magnitude 7.7, and it was light bluish green; such it remained, with a few slight increases and decreases in the depth of its hue, through June 10, by which date it had dropped to the ninth magnitude, and after which it could no longer be followed on account of its low position in the evening twilight. And now we are come to the present observations. With the single exception of 1913, August 27, when it was for the final time recorded as light bluish green, and had declined to the 9.5 magnitude, Nova (2) Geminorum has faded out to a very pale bluish white,—which, as I have remarked, is but well nigh a perfect white*. From first to last, we consequently discover that it has passed through all of the following colors: very pale yellow, very slight pink, creamy white, all shades of red—from a light pink to a decidedly deep red—again pinkish white†, greenish white, alternately very light greenish blue and very light bluish green, ultimately into a very pale bluish white. This may reasonably be said to be a résumé of its chromatic variations. From beginning to end, *i. e.*, from the date of its discovery, 1912, March 12, through 1914, April 21, my last view, it has declined from magnitude 3.5, on March 14, the date of its maximum brightness,—naked-eye visibility,—to magnitude 11.2,—the theoretical limit of a 2½-inch telescope,—a drop *in toto* of 7.7 magnitudes within two years, one month and nine days, and, according to my observations, it has experienced, during that period, all of the complex fluctuations in color above enumerated.

It appears now, in view of an additional year's observations and knowledge of the Nova, that it is gradually fulfilling the predictions suggested in my note in *P.A.*, XXI, 7, pp. 437-438, in which I stated that seemingly the star was then slowly fading out. This much at least can definitely be inferred regarding it, namely, that it has already closely approached the theoretical limit of light-gathering capacity of a 3-inch refractor, and that it is probable that it is but a question of time now when this wonderful star will pass entirely out of the range of small apertures.

---

* It is seen also (*P.A.*, XXI, 6, pp. 366-367), that the Nova was virtually white from 1913, April 28-May 7, since it was then of such delicate tints as "very light," "very pale," and "rather light bluish green." I mentioned this in the discussion of my observations for 1913, April 10-May 12, in these words: "From April 28 through May 7, the star was generally unusually light, on one night in question (April 29) being almost pure white (a very pale bluish green) in hue, as far as could be discerned with the telescope." This was indubitably the commencement of its pronounced fading in color, thus begun over a month before it passed into the sun's rays, although from May 12-June 10, it was light bluish green.

† See second footnote on preceding page.

TELESCOPIC APPEARANCE AND FOCAL LENGTH.

On two different occasions I carefully studied the Nova under high powers to detect any possible differences that might exist in its telescopic appearance, from that of an ordinary star* My first observation of this kind was made on the morning of 1913, August 30, and the second on the morning of September 27 (civil dates). The notes of these observations follow:

1913, August 30.—Nova examined very carefully with powers of 120 and 180 diameters on the 4-inch telescope. In neither power, however, was the general appearance of the star different from that of any ordinary stellar object. (Definition very good, and air fairly steady; seeing exceptional for the early morning.)

The color of the Nova seemed different this morning from what it was on the preceding observation (August 27; see table, *ante*), it being very light—estimated as a very pale bluish white. The star was doubtless light bluish green on the former occasion simply on account of its extreme proximity to the moon, as there is no ground to suppose that the color could have altered so materially within three days' time. On both observations, this was probably very pale bluish white.

1913, September 27.—Nova observed, ×120. Image the same. (This observation was obtained under unusually good definition for the morning.)

After 1913, September 27, the Nova was too faint to permit of any further investigations of its physical appearance†.

Concerning the telescopic appearance and focal length of the Nova, I include in this paper, with the writer's kind permission, the substance of the following two notes by Professor E. E. Barnard: *Astronomische Nachrichten*, Band 196, Nr. 4689 and Band 198, Nr. 4736, entitled "Change in the Focus of Nova Geminorum 2."

---

* It is well known that the general appearance, and sometimes the focal length, of a number of novæ, under very great powers, is apt to be quite different from those of a usual star. See a paper by Professor E. E. Barnard, entitled, "The temporary stars. On the present appearance of some of these bodies," in the *Astronomische Nachrichten*, Nr. 4655. The peculiarities in focus alluded to would not of course be perceptible in anything but a very large refractor, due to its inherent quality of chromatic aberration, which, in its case, results in rather widely separate foci for light of different colors. The focal changes of the Nova were therefore entirely inappreciable with my 4-inch telescope, although measurably evident in a giant instrument such as the Yerkes, of which mention will again be made later.

† A reference to former observations (*P. A.*, XX, 6, p. 380) shows that on 1912, March 15 and April 24, on which nights I made a similar study of the Nova, with powers of 84 and 126 diameters on my 3-inch telescope, I found its disc in no respect different from that of an ordinary star.

In the first of these notes, on 1913, October 7, Professor Barnard writes that the object "was very white, and badly out of focus—quite large and blurred. When at the best focus it resembled a small bright nebula some 2″ in diameter. This focus was 6 mm. outside the regular focus." The observation was made with the 40-inch telescope of the Yerkes Observatory, and through a break in the clouds. In the latter, he states that "This was subsequently verified on November 11, when the focus under good conditions was 5.2 mm. greater than for a star. At these times, when at its best focus, the Nova resembled a small bright nebula some 1″ or 2″ in diameter." He then gives a series of observations extending from 1914, January 24 through February 15, in which the focal variations on the various dates in question were—

1914	mm.
January 24	+ 2.1
31	— 0.2
February 14	+ 0.8
15	0.0,

"where the plus sign indicates that the focus was greater than the normal." On January 24, the star is described as "white, perhaps bluish white," and on the last three, "Like an ordinary white star, but not bluish white." Professor Barnard remarks further that "The Nova seems, therefore, to have changed its focus and general appearance back again to the normal. The two last observations, especially the last, were made under good conditions.

"This rather rapid change to the abnormal and back to the normal focus resembles that of Nova Persei 2 (Anderson) in the fall of 1902 (*A. N.* 4285)."

I append these data as indicative of the inevitable differences in delicate work of this sort that must necessarily exist between a small and a great refractor; but Professor Barnard's color estimates strengthen my contention that the Nova really was of a very light bluish white hue, and they tend to indicate, moreover, that it very likely faded out to an absolutely *perfect* white, long after its tinge became too feeble to be distinguished in a 4-inch telescope (1914, January 31, February 14 and 15).

1338 Madison Park, Chicago, Ill.,
1914, July 25.

STAINED GLASS PANELS FROM TULSE HILL OBSERVATORY HOUSE.

PRICELESS ACCESSIONS TO WHITIN OBSERVATORY WELLESLEY COLLEGE.

SARAH F. WHITING.

> "As Newton accomplished the extension of terrestrial dynamics to the heavens, so William Huggins extended to the skies the laws of terrestrial physics."

It is well known that before the death of Sir William Huggins the major instruments of the Tulse Hill Observatory were removed to Cambridge, England. There they are set up in a new observatory presided over by Professor H. F. Newall, the first to occupy the newly created "Huggins Chair of Astrophysics".

The Tulse Hill home connected with the observatory, where so many American astronomers have found cordial welcome, was after the death of Sir William quite dismantled, and its wealth of treasures scattered. Lady Huggins removed to Chelsea where on the site of the former residence of the famous Sir Thomas More, beside the Thames, in a choice apartment, she is still working, as her delicate health permits, upon a memoir of her husband.

Any book which comes from her hand may well be anticipated, for no such beautiful volumes grace the shelves of the libraries in Astronomy as the two Tulse Hill Observatory publications:—the "Atlas of Representative Stellar Spectra" and "The Scientific Papers." There is a third equally perfect book edited by Lady Huggins,—"The Royal Society." In this, in addition to the four notable addresses which Sir William gave as president of the Royal Society, is included its history and a wealth of illustration.

Lady Huggins has been pleased to deposit in Whitin Observatory of Wellesley College—a Woman's College, in the new world—certain of her more personal astronomical possessions. Herself a pioneer in science, one of the remarkable women of the transition period, who without the modern college training, has made herself an authority in many lines, she has been deeply interested in the new opportunities for women opened in this generation. She often expresses herself solicitous that the younger race should not lose a whit of the earnestness and depth of scholarship which characterized such early leaders as Mary Somerville and Anna Swanwick.

The gift to Wellesley includes two stained glass panels once in the doors at Tulse Hill, but now combined in one window at Whitin Observatory.

The left hand panel is from the Bayeaux Tapestry. It represents the untutored crowd gazing into the sky and pointing at the portentous comet of 1066, which we now call Halley's comet. "*Istimerant Stella*" is the inscription above. On the second panel, Sir William chose to group the typical objects of wonder and study in the sky. Here are represented not only the comet, but the great sun with its chromosphere and corona, the nebulae and stars. But across the panel in brilliant colored glass is the sun spectrum, with the well-known lines of Fraunhofer in place, and below a second spectrum with the bright lines characteristic of a gaseous nebula discovered by Sir William. Here is typified the finite mind of man wondering at and baffled by the riddle of the universe until the spectrum gives hope of solution.

The third glass panel is for the Observatory House. It is specially precious as it was a silver wedding gift to the astronomers. The recipients chose the subject and Lady Huggins directed, as in the other case, the coloring and leading of the glass. This panel represents Christian in the Pilgrims Progress meeting the three shining ones, one of whom salutes him with the comforting phrase, "Thy sins be forgiven thee,"—the second bids him exchange his rags for fair raiment,—the third gives him a sealed roll, his passport to the Holy City. Lady Huggins remarks that this window was placed where everyone in the house saw it in the morning, and that it always reminded them of spiritual presences and help.

All the glass is, as far as possible, pure pot-metal color, in the style of the thirteenth century and designed with a knowledge of glass work.

The students who crowd the Whitin Observatory will certainly find, as did the donor, "that the influence of good stained glass is great and quite peculiar."

Another most interesting object is the seal of Sir William used by him on all important documents especially during his five years presidency of the Royal Society. It was designed by Lady Huggins, and was made in glass paste by Tassie of London, a copy of a fifteenth century gem in a cabinet in Paris. The subject is Apollo in his car driving the horses of the sun in the midst of the zodiac. The impression from the seal in wax is so clear that each separate horse of the quadriga and every minute figure of the signs of the zodiac is easily distinguished. The handle of the seal is in silver gilt. The latter was picked up by Lady Huggins in Holland, a seventeenth century piece of work, originally a knife-handle. It represents St. George slaying the dragon. The subject is treated in a most unusual and difficult manner with wonderful skill. The horse and rider are standing vertically.

Lady Huggins knows of no other vertical treatment of a horse and rider save on the doorway of the Cathedral of Notre Dame in Paris.

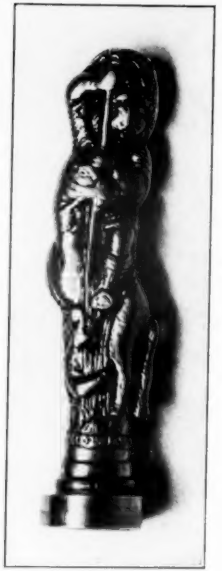
PLATE XXII

STAINED GLASS PANEL.

A Silver-Wedding Present to Sir William and Lady Huggins

Arabian Astrolabe, diameter 3.5 inches, Pin, Wedge, Rule.

Astrolabe without Plates and Rete, showing Names of Cities with Latitude and Longitude. The Rete, each Point showing the Position of a Star, with the Name on the Leaf.



The Seal of Sir William Huggins.

Here are carved in small rectangles scenes from the Apocalypse. Death on the pale torso is represented by a woman, who leaping up in front of a man stabs him. He falls off clinging to the horse's neck and is making a mad rush in an agony of terror.

This description by Lady Huggins caused the writer, in a pouring rain, to search on the doorway of the famous cathedral for this detail, and she was rewarded by discovering many other wonders of mediaeval carving.

Sir William and Lady Huggins loved to feel the atmosphere of antiquity which invests the science of astronomy, to trace in its development the awakening intelligence of the race. This was witnessed some years ago by an illustrated article in POPULAR ASTRONOMY by Lady Huggins on an Astrolabe in her possession.

An object of great historic interest in the gift to Wellesley is an Arabian Astrolabe. It is not the one just referred to, but one as perfect. Much decorative skill as well as scientific knowledge was employed upon these instruments. On this specimen the decorations are most artistic and effective. There are remains of red enamel on the "throne" or top part, and such decoration was not usual. The wedge which holds the index in place, the head of a crested bird is most picturesque; the "Rete" or "Spider," the open work disc is most charming; on this is the zodiac and pointers like delicate leaves with Arabic characters upon them which show the positions of twenty-four stars in both northern and southern hemispheres.

By the kindness of the Professor of Arabic at Harvard University, the names of these reference stars have been read and the crowded characters on the instrument beneath the movable plates have been also interpreted. Here are the names of almost every city in the east, —Mecca, Medina, Bagdad, Samarcand—with the latitude and longitude of each, the longitude in every case reckoned east from the Azores. There are five plates for different latitudes on which the concave vault of the sky is projected on a plane parallel to the equator and the almucantars and vertical circles are drawn for every ten degrees.

On the arrival of the Astrolabe at Wellesley we immediately consulted Chaucer's treatise on the Astrolabe written for "litell Lowis my sone." It reads like a laboratory book of directions. In it we have found how the leader of a caravan could get his time and place as he crossed the desert, or how Columbus could keep his course westward, by observations on the "Pole Star" and "the Guards," that is *beta* and *gamma Ursae Minoris*.

The use of the Astrolabe is not quite so easy as one might think from Chaucer's statement to his little son that he does not describe

all the "conclusions apertaining to the same instrument.....since some of hem ben to harde to thy tendre age of ten yeer to conserve."

It so happens that the writer picked up in Germany last summer a book of 1597 concerning the making and use of diverse instruments of Astronomy and Cosmography. The book had a beautifully designed and engraved title page and some remarkable diagrams, with circles and pointers which moved, which attracted her attention but it was not until an astrolabe was examined and the numerous cuts in the book compared, that it was apparent that directions for every detail for projecting the circles, placing the points for the stars and graduating an astrolabe were given in the book. So interesting is all this that one is tempted to continue Italian, for the book is in that language, turn back the pages of time and leave investigating the micrometer screw of a modern measuring engine to make and use an ancient astrolabe.

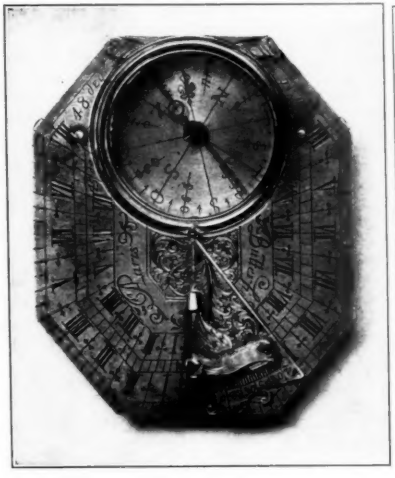
A ring sundial which was carried in a gentleman's pocket before the day of watches is another antique. When the circles are adjusted to the latitude and the tiny hole, through which the ray of sunlight passes, to the declination, and the meridian circle is held north and south by the swivel ring, the time could be told quite near enough for the days of slow movement.

Another sundial, picked up from the famous Spitzer collection in Paris, added to the collection by the writer, is yet more exquisite. It is of silver and fits into a case scarcely larger than a good-sized watch. The gnomon can be turned up by a hinge; on it a bird's beak serves for an index to set it to the latitude and a compass to place it in the meridian. Two scales of hours are engraved on the face and on the under side are the names of the principal cities of Europe with their latitude. These sun-dials were made in Paris about 1750.

To come to more modern things we shall highly prize a Rutherford diffraction grating which Lady Huggins thinks most fitting to place in a permanent home in the land from which it came. It will be remembered that Rutherford of New York was one of the first to photograph the sky. Columbia University Observatory possesses his plates and has made them useful for investigations. Our observatory is fortunate to possess one of his really fine photographs of the moon taken by the old wet collodion process. Rutherford worked upon the sun-spectrum, and wishing to follow Fraunhofer in the use of a grating, proceeded to invent and construct a dividing engine, and to rule gratings. This one he gave to Sir William Huggins, who used it much after he had it mounted by Hilger with a quartz plate cover. In the early eighties of the last century thirteen hundred and eighty lines was a large number to rule in the inch.

ENGLISH UNIVERSAL RING DIAL

A kind of Armillary Sphere in general use over Europe
from beginning of 16th century



SILVER DIAL BY MACQUART OF PARIS ABOUT 1740.

The bird Style, which can be adjusted to the latitude, can be folded flat so that the dial may fit in a case.

There are in this gift three small instruments which were specially constructed for the Huggins's to take on their vacation trips:—an Adams pocket sextant, a beautiful thing, most ingenuiously packed in a small case; a Dolland traveller's telescope with four powers and a dark glass, also so cleverly arranged that while it will show the moons of Jupiter and divide double stars it can be carried in a small travelling bag. Lady Huggins remarks that such things are no longer made. The third instrument is a little reflecting telescope by J. Cuthbert, with four powers and a finder. It is of the Gregorian form with pierced mirror. This also will divide the easier double stars and show sunspots.

Besides drawings, manuscript and some historic negatives the collection includes several pictures of interest. The finest is an unusually successful large reproduction of the portrait of Sir William Huggins by the Hon. John Collier. This portrait is in the rooms of the Royal Society. Lady Huggins asked the artist to sign the copy she sent and also appended the signature of Sir William. It now hangs near the astronomical window and the case of memorial gifts, and beside it we have placed that fine portrait of Darwin showing the face with its impressive forehead and overhanging brows almost in profile. Darwin is here in appropriate company, for when the new science of astrophysics revealed the constitution of the stars astronomy was immediately annexed to the subjects pursued after the Darwinian manner and problems of stellar solution could be solved.

But the true significance of a memorial gift and its inspirational value depends upon the personality of those from whom it came, what they were and what they achieved.

Here we have reminders of the work of scientists of the first order, and of their wide range of related interests. Lady Huggins is not only an astronomer, but her cultivation in many lines of art has been revealed to her friends by the reproductions of exquisite watercolors and etchings which frequently came with holiday greeting, now and then accompanied by a verse of true poetic feeling.

It is quite impossible to reproduce with vividness after the lapse of years original impressions, it may therefore be permitted to quote from a letter written in 1896 after my first visit to the Huggins's.

"I must tell you of my astronomical experience,—a visit to the Huggins's whose work is considered most remarkable and whose charts of star spectra I use with my classes. I was invited there Monday. A lovely lady, who was not at all ordinary, but like an embodied poem or piece of music met me at the door. She had a spirituelle face set with gray hair, she wore a trailing satin skirt and red velvet loose jacket of quaint cut. Behind her was Mr. Huggins, a distinguished looking man with remarkable eyes. The drawing room through which I was

led was a most refined room, the walls covered with pictures from the Old Masters. The library was next, its walls covered with books in cases separated by richly carved panels, the wood carving done by Mrs. Huggins. The end of this room was almost entirely of plate glass, so that on a dark English day it would appear as if one were sitting in the garden, in the center of which I noticed an armillary sundial.

"I had a wonderful scientific séance, saw the historic photographs of star spectra and felt the thrill of excitement with which these negatives were first examined. I saw the twin telescopes and spectroscopes of most ingenious form. Later I was taken to the music room;—both Mrs. Huggins and her husband are musicians. The collection of historic violins and flutes was shown and a series of detail pictures from the works of the old masters which illustrate the evolution of the violin. Then we had tea in an equally interesting dining room."

This was the year of Queen Victoria's diamond jubilee. One morning the columns of the *London Times* recorded a long list of names of those whom the queen delighted to honor,—there was no woman on this list, and but one woman was remotely alluded to. Doctor William Huggins was made a K.C.B. "for the eminent contributions to astronomical science which he had made with the colaboration of his accomplished wife." Lady Huggins, for such she then became, as it were by her own right, had great skill in guiding the telescope for long spectrum exposures, also in developing the plates, in discovering the sequence of spectrum plates, in framing new questions to put to nature and finally in putting the results of the Tulse Hill work before the world.

The writer once remarked to Lady Huggins her absence from some notable scientific gathering. "Oh, we never go anywhere," was her reply "Astronomy is a heart-breaking science in England. We get something on our plates between the clouds some night which opens up a great question, and then watch and wait for opportunity to answer it. Perhaps clouds compel us to wait weeks, perhaps even till another year."

In the cabinet with the memorial treasures has been placed Sir William Huggins' favorite life-verse which stood before him on his study table and which he delighted to give, especially to his younger friends.

> "Then away with Longing, and ho for Labor!
> And ho for Love—each one for his neighbor
> For a life of Labor and Study and Love
> Is a life that fits for the joy above."

Whitin Observatory, Wellesley College,
Wellesley, Mass.

A SYSTEMATIC SEARCH FOR BRIGHT NOVAE.

LEON CAMPBELL.

It is a well known fact that practically all the Novae of either historic or present times have been found in or near the Milky Way, as for example in the constellations of Cassiopeia, Perseus, Auriga, Sagittarius, Norma, and Carina.

The two most interesting Novae of the present century, Nova Persei No. 2 and Nova Geminorum No. 2, have been discovered by two variable star observers, Messrs. Anderson and Enebo, who are experts in their line, and who have acquired a perfect knowledge of many of the naked eye configurations in the pursuit of their variable star work. Photography, now so universally applied by many of the larger observatories, would doubtless have eventually secured evidence of their presence, but probably not at a date in the history of the Novae to be of the greatest value in making the most important study of the phenomena. The very prompt discovery of both of the above mentioned Novae attests to the great value of early detection and has proved a remarkable aid to astronomers in studying their light changes and spectra, and this could not have been attained, had it not been for such keen observers.

The observers best fitted for the search for Novae, appear to be among the amateur and semi-professional astronomers, since the professional astronomer seldom has occasion to study the constellations in detail with enough frequency to make such a search worth the while. There are at present two large scientific bodies, the American Association of Variable Star Observers, under the auspices of Harvard College Observatory and POPULAR ASTRONOMY, with Mr. W. T. Olcott as Secretary, and the Variable Star Section of the British Astronomical Association, under the directorship of Mr. C. L. Brook, which are doing valuable work in the study of variable stars, both of the brighter and fainter classes. To these organizations it seems best to look for the work of a systematic search for bright Novae.

By dividing that part of the heavens most likely to reveal such Novae into sections of nearly equal area, having due regard to the constellations, it would not be very difficult or arduous for one to so familiarize himself with the region especially allotted to him as to easily detect any new star that might appear, even if only as bright as the fifth magnitude. By studying his region very carefully so as to know the configuration perfectly, even extending to the fainter stars, he would notice any slight alteration as easily as he would note when one letter of his own name was misplaced.

Schurig's Star Atlas is well suited to this purpose, not only because of its clearness and accuracy, but from the fact that it is convenient to handle and cheap. It would be necessary for some one person, as the Secretary of the A. A. V. S. O., or the Director of the V. S. S. B. A. A. to take the responsibility of assigning the proper regions to each observer desiring to take part in such a search, to avoid unnecessary duplication or omission, and then for each observer to faithfully perform his part by observing the region carefully at each available opportunity and frequently, making his notes as clear as possible, even though negative results were obtained for a long time.

The following list of regions suggests itself as convenient and one which should not entail too much work on the part of any interested observer. The number of the region, with the limiting boundaries expressed in Right Ascension and Declination as marked on Schurig's Atlas, with the principal constellations lying in each, are given in the successive columns.

No.	Limiting Right Ascensions				Limiting Declinations		Principal Constellation
	h	m	h	m	°	°	
1	18	40	to 21	20	+50	to +70	Cygnus, Cepheus
2	21	20	to 23	20	+50	to +80	Cepheus
3	23	20	to 1	20	+50	to +80	Cassiopeia
4	1	20	to 3	20	+50	to +80	Cassiopeia
5	3	20	to 6	00	+50	to +70	Camelopardalis
6	18	40	to 20	40	+30	to +50	Cygnus, Lyra
7	20	40	to 22	40	+30	to +50	Cygnus, Lacerta
8	22	40	to 0	40	+30	to +50	Andromeda
9	0	40	to 2	40	+30	to +50	Andromeda
10	2	40	to 4	40	+30	to +50	Perseus
11	4	40	to 6	40	+30	to +50	Auriga
12	15	40	to 17	20	+20	to +40	Corona Borealis
13	17	20	to 18	40	+10	to +40	Hercules
14	18	40	to 20	40	+10	to +30	Sagitta, Vulpecula
15	6	40	to 8	00	0	to +30	Canis Minor, Gemini
16	4	40	to 6	40	+10	to +30	Taurus
17	4	40	to 6	40	+10	to −10	Orion
18	6	00	to 7	20	0	to −30	Canis Major
19	7	20	to 8	40	0	to −30	Puppis
20	16	00	to 18	00	+10	to −10	Ophiuchus
21	16	00	to 18	00	−10	to −30	Ophiuchus
22	18	00	to 20	00	+10	to −10	Serpens, Scutum
23	18	00	to 20	00	−10	to −30	Sagittarius
24	6	00	to 8	00	−30	to −60	Puppis
25	8	00	to 10	40	−30	to −50	Vela
26	14	40	to 16	40	−30	to −50	Lupus
27	16	40	to 18	40	−30	to −50	Scorpius
28	8	00	to 10	40	−50	to −75	Carina
29	10	40	to 13	00	−50	to −75	Crux
30	13	00	to 15	20	−50	to −75	Centaurus
31	15	20	to 18	00	−50	to −75	Norma, Triang. Aust.

The Harvard Annals contain magnitudes on a uniform scale for practically all of the stars in these regions, and by noting them to tenths against each star on the separate charts, one has at hand the ready

means for estimating the brightness of a Nova, should one suddenly appear, and incidently for observing any bright variable stars that may lie in the region.

In order that prompt attention may be given to the observing of a newly discovered star, the discovery, when confirmed, should be communicated to the nearest observatory of importance, or directly by telegraph to one of the distributing agencies, the Harvard College Observatory, Cambridge, Mass., U. S. A., or the Centralstelle, Kiel, Germany. The message should be clear and concise, giving its position, if only with reference to adjacent stars, and its magnitude.

As the light changes in Novae are usually very sudden and irregular, frequent observations of the brightness should be made on some definite scale, and at stations as widely distributed in longitude as possible. For example, the recent Nova in Gemini was very carefully observed in Europe and Eastern and Central North America, but very few observations were obtained in Western America or in Asia, especially during its early history. Had such observations been obtained, many doubtful variations in the light curve could have been more accurately confirmed or disproved. It is especially desirable that observations be made at stations between 120° west and 60° east longitude. It would, therefore, be advisable to secure observers in that part of the world, and to cable them news of such discoveries at the earliest possible moment.

In making the observations, the observed times as well as the estimates of magnitude, preferably by the so-called Argelander's method, should be carefully noted, taking care to stipulate exactly the comparison stars used in every case. By this plan, anyone caring to make a detailed discussion of all the available observations will have at hand sufficient material to deduce the best possible light curve.

The writer has now practically ready for the press a compilation of over three thousand observations of Nova Geminorum No. 2, which will appear in the Harvard Annals at an early date, in a form similar to the discussion of Nova Persei, No. 2, in Harvard Annals **48**, No. 2.

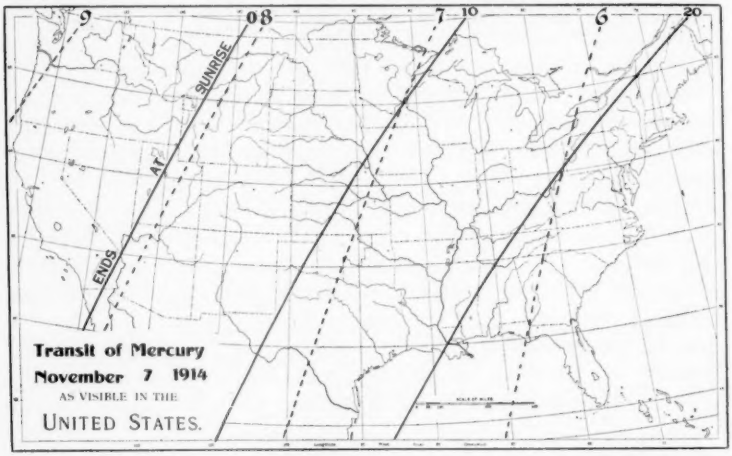
The watch of the northern sky should be easily taken care of by the plan mentioned above, and doubtless enough observers could be secured for the southern sky, if sufficient interest was aroused among them. The two observers now at the Arequipa Station of the Harvard College Observatory can be held responsible for regions 29 and 30. It may take some time to attain results from such a campaign, but the reward is well worth the time and energy spent, not only to the fortunate discoverer, but to the astronomical world at large.

Harvard College Observatory, Arequipa Station.
Arequipa, Peru.

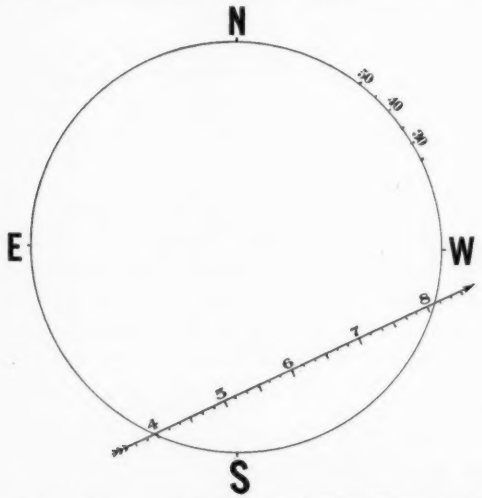
TRANSIT OF MERCURY 1914, NOVEMBER 7, AS VISIBLE IN THE UNITED STATES.

WILLIAM F. RIGGE

The coming transit of Mercury, 1914 November 7, will be only partially visible in the United States. The sun will rise with the planet



on its disk, so that only the egress may be observed. This will take place at about 8:08 A.M., Central Time. The numbers 0, 10, 20, on the



THE PATH OF MERCURY ACROSS THE SUN'S FACE, NOVEMBER 7, 1914.

accompanying map of the United States show the number of degrees in the altitude of the sun at the time. West of the line 0 the transit will not be visible at all. The broken lines 6, 7, 8, 9, indicate the central times of sunrise.

The second figure shows the path of Mercury across the sun's face. The letters N. S. E. W. are the cardinal points of the disk. The sun's vertex at the time of the planet's egress will be at the points marked 50, 40, 30, for the corresponding degrees of latitude.

HOW TO FIND THE CONSTELLATIONS.

Editors Note.—Much more pleasure can be derived from looking at the sky when one can trace the constellations. These can be found easily, even by those to whom the constellations are unknown, by following simple directions. This has been done, as will be explained in the following article prepared by three students of astronomy in the College for Women, Columbia, South Carolina, to whom the constellations were unknown. The article will be continued in several successive numbers of this magazine.

MARY H. DUNOVANT, SARAH L. MAYES AND SARAH W. WEINGES.

I. The Big Dipper.

One may easily find the Big Dipper on a bright clear evening about the third week of April. Face the north and imagine a line drawn from the north point of the horizon straight up through the sky to the point overhead called the zenith. On this line about half way up will be seen a group of seven bright stars, which can easily be imagined to out-line a dipper with the bowl turned down-ward and the handle extending to the right. The bowl is composed of four stars and the handle which is bent in the middle, is composed of three. The two stars on the opposite side of the bowl from the handle are called the "pointers", because they point to the north star, which can be found by drawing a line straight through them and extending down-ward a distance five times as great as that between the pointers. The north star can be easily found, because it is very bright and seems to stand quite alone.

There are many interesting things about the Dipper—it gets its name from its shape. The English call it the "Plow" or "Charles' Wain". They also know it as the "wagon". The four stars in the bowl form the wagon and the three stars in the handle the horses. In Shakespeares' "King Henry IV" the Big Dipper is spoken of as the "Time Keepers."

The North American Indians, too, were attracted by the beauty of this constellation and have a very interesting legend about it. They supposed the four stars in the bowl to be a "Bear" and the three stars in the handle to be "hunters" in pursuit. The first hunter has a bow and arrow, with which to kill the bear. The second is carrying a pot in which the "bear" is to be boiled after its capture. And the third is carrying an armful of sticks, with which to make a fire under the pot. Only once a year does the hunter succeed in wounding the bear and the Indians believed that the foliage of the forest in the fall was colored by the dripping blood of the bear.

There are certain interesting facts about the stars of the Big Dipper. It has been found by the late Richard A. Proctor that the seven stars which form the Big Dipper have different motions. He found that five stars were drifting in one direction and two in the opposite at the rate of eighteen miles per second. The diagram below shows the change in position of the stars thirty-six thousand years hence.

CHANGE IN THE GREAT DIPPER IN THIRTY-SIX THOUSAND YEARS.

The seven stars are suns, much larger than our own sun. Those stars are so far away from us that if our sun could be placed near the nearest of them it would not look as bright as the faintest of the seven.

The Big Dipper forms a part of Ursa Major or the Big Bear. The bowl of the Big Dipper forms the hind quarter of the Big Bear and the handle of the Dipper the tail of the Bear. Draw a line through the two stars in the top of the bowl and extend it in the direction opposite the handle to a distance equal to that between the two stars in the top of the bowl Here we find a bright star which marks the neck of the Bear. Extending this line still further and slightly upward, we come to another star which marks the nose. The Bear is lying on his back. Draw a line straight upward from the star in the nose about twice the distance between the pointers and it will fall on two stars which form the front foot, two stars being in the leg. From the front foot draw a line to the right extending slightly upward. This line will pass through both hind feet. The distance between pointers is five degrees. With this distance as a measure, one hind foot is about twenty degrees from front foot and the distance between the hind feet is about fifteen degrees. Comparatively bright stars connect these hind feet with the two stars in the right end of the bowl.

With the aid of these directions and the star map which is published in every issue of POPULAR ASTRONOMY this constellation may be traced without much difficulty.

DISCOVERY OF THE NINTH SATELLITE OF JUPITER.

SETH B. NICHOLSON.

On July 21, 1914, while volunteer assistant for the summer at Lick Observatory, I photographed the eighth satellite of Jupiter with the Crossley Reflector. On the following night a second plate was secured, and in comparing the two negatives a new image was found, about one minute of time east, and six minutes of arc south of the eighth satellite. The two exposures had been made by setting off the motion of the eighth satellite, and the new object showed almost no trail. It was estimated about one magnitude fainter than the eighth, and, judging from the distinctness of the images on the plates, which were of two hours exposure, it must be nearly nineteenth magnitude. On the 23rd and 24th of July it was again photographed, and as soon as the positions were obtained from the plates of July 21 and 22, telegraphic announcement of the discovery of the unidentified object was made by Acting Director Tucker, of the Lick Observatory. The object was followed until the end of July, when the moon became too bright to permit of further observations.

I then returned to Berkeley to investigate the nature of the orbit. A general solution was undertaken by Leuschner's Method of Direct Solution of Orbits of Disturbed Bodies, on the basis of attractions of the Sun and Jupiter, using the observations of July 22, 27, and 31. Three distinct orbits resulted from the preliminary solution, all of which satisfied the three observations. Two of these orbits belong to Jupiter and the other to the sun. The latter, and one of the Jupiter orbits, were hyperbolic, the other elliptic. Since all three orbits satisfied the available observations, it was necessary to secure additional photographs before the true one could be selected, for although the two hyperbolic orbits were recognized as exceedingly improbable, the problem in hand demanded not only the proof that the elliptic orbit would satisfy future observations, but also that the other two orbits were impossible. Positions were computed from the ellipse for August 21 and 23, and at that time I went to Mount Hamilton to secure further observations. The object was found very near the predicted place on the three nights of August 21, 22 and 23.

Of the three orbits the ellipse around Jupiter was the only one that represented these observations satifactorily, thus proving the ellipse to be the real orbit, and establishing the identity of the object as a newly discovered satellite of Jupiter. The fact that this identity could be established without previous assumptions by Leuschner's method

particularly from observations so close together—the entire interval for the original solution being only nine days—shows the remarkable efficiency of the method. The elements of the orbit are of course only approximate, but they serve to establish the identity of the object and to describe the nature of the orbit, which is very similar to that of the eighth satellite. The motion is retrograde, and the period about three years. Further details will be published in a *Lick Observatory Bulletin.*

University of California.
September 17, 1914.

DELAVAN'S COMET.*

E. E. BARNARD.

I have followed this comet photographically from its first appearance in the morning sky in July. There is but little in the way of structure in the various photographs of it. The tail—at least the fainter portion of it—has been very slow in its action on the sensitive plate. Long exposures have been required to show the tail, and then probably its full length has not been recorded. There have, however, been but few nights when the moon was away that were suitable for such work.

The physical appearance of the comet has varied but little. Two widely diverging tails have been persistent, and the angle between them—some 30°—has remained nearly constant. The different nights have given photographs that are almost duplicates. Some interesting phenomena have shown at times, but nothing of a remarkable nature. I have photographed the comet on 27 nights, up to the present date, since July 25. Four of these dates include evening and morning photographs. The most interesting are those of September 17 and 22, which show the two branches of the tail, as usual, but these tails are quite distinctly different in appearance, the south tail being broad and diffused without any detail, while the north tail is full of striking structure. The contrast in appearance between the two is very remarkable. Possibly they are of a different physical or chemical nature.

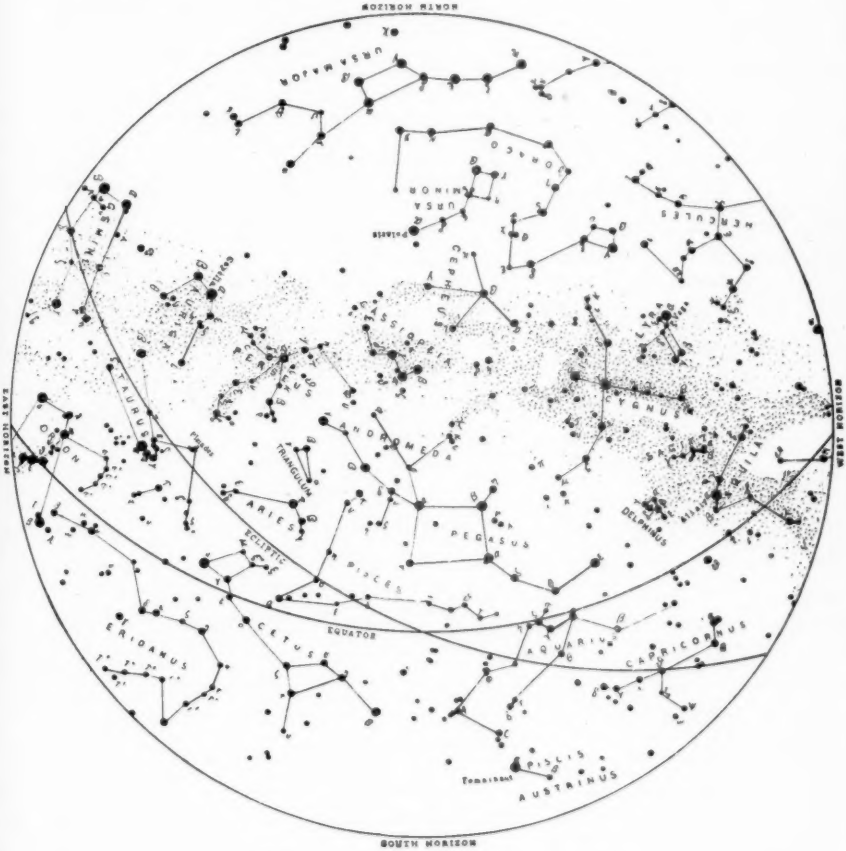
To the naked eye the comet has been a rather striking feature in the early mornings in the northeast sky, and later in the evening. The head has been as bright as the third magnitude and the tail, which is bright for a couple of degrees, can be traced for 6° or 8°. The eye sees perhaps as much of the tail as is shown in the ordinary photographs.

Yerkes Observatory.
Williams Bay, Wis.
1914 September 25.

* See Plate XX, Frontispiece.

PLANET NOTES FOR NOVEMBER, 1914.

The sun will move southward from fourteen degrees south to twenty one and one half degrees south during the month. It will move eastward from the constellation Libra into Scorpio, and by the end of the month will be a few degrees north of the bright star Antares. At this date it will be near its farthest point south.



THE CONSTELLATIONS AT 9:00 P. M. NOVEMBER 1.

The phases of the moon for the month are as follows:

Full Moon	Nov. 2	at	6 P.M.	C. S. T.
Last Quarter	10	"	6 P.M.	"
New Moon	17	"	10 A.M.	"
First Quarter	24	"	8 A.M.	"

Mercury will be moving westward in the early part of the month, and on November 6 it will transit the sun's disk. This interesting phenomenon will be partly visible at Washington. It will move rapidly westward and on November 23 will have reached a point of greatest western elongation. At this date it will be several degrees north of the sun and will rise more than an hour before it. It will therefore be visible to early morning observers.

Venus will be conspicuous in the southwest at sunset at the beginning of the month. It will be moving westward rapidly and will soon be too near the sun to be visible. On November 27 it will pass between the earth and the sun, although it will not cross the sun's disk as Mercury does on November 6.

Mars will move eastward at about the same rate as the sun throughout the month. It will be too near the sun for observation at any time during this period.

Jupiter will be in quadrature, ninety degrees east of the sun, on November 6. At this date it will therefore be on the meridian at sunset. It will be moving northward slowly and will be in good position for evening observations throughout the month.

Saturn will be in the morning sky during this month. It will cross the meridian about two a. m. It will rise earlier from day to day.

Uranus will be near the meridian at sunset throughout the month. It will therefore be in favorable position.

Neptune will rise before midnight and will be well up in the sky for observation shortly after midnight.

Occultations Visible at Washington.

Date 1914	Star's Name	Magnitude	IMMERSION. Washington M.T.	IMMERSION. Angle f'm N.	EMERSION. Washington M.T.	EMERSION. Angle f'm N.	Duration
			h m	°	h m	°	h m
Nov. 5	354 B Tauri	6.4	16 30	32	17 7	338	0 38
6	415 B Tauri	6.1	7 50	43	8 32	302	0 42
7	39 Geminorum	6.2	9 4	130	9 48	229	0 44
8	5 B Cancri	6.4	12 56	54	13 48	329	0 53
11	49 Leonis	5.7	13 12	53	13 40	357	0 28
19	210 B Scorpii	5.8	5 47	110	6 39	227	0 52
30	ϵ Arietis(mean)	4.6	2 54	49	3 44	266	0 49

VARIABLE STARS.

Approximate Magnitudes of Variable Stars of Long Period on Sept. 1, 1914.

[Communicated by the Director of Harvard College Observatory, Cambridge, Mass.]

Name.	R. A. 1900. h m	Decl. 1900. ° ′	Magn.	Name.	R.A. 1900 h m	Decl. 1900 ° ′	Magn.
X Androm.	0 10.8	+46 27	<12.0	SS Herculis	28.0	+ 7 3	9.0
T Androm.	17.2	+26 26	<12.0	W Herculis	31.7	+37 32	9.2
T Cassiop	17.8	+55 14	10.1 *i*	R Urs. Min.	31.3	+72 28	9.3
R Androm.	18.8	+38 1	11.6*d*	R Draconis	32.4	+66 58	12.4 *i*
U Cassiop.	40.8	+47 43	<13.0	RR Ophiuchi	43.2	−19 17	10.2*d*
RW Androm.	41.9	+32 8	12.2*d*	S Hercuiis	47.4	+15 7	8.4*d*
V Androm.	44.6	+35 6	11.0*d*	RR Scorpii	50.2	−30 25	10.0*d*
RR Androm.	45.9	+33 50	<12.0	RV Herculis	56.8	+31 22	13.2*d*
RV Cassiop.	47.1	+46 53	<12.0	R Ophiuchi	17 2.0	−15 58	7.7
W Cassiop.	49.0	+58 1	11.2*d*	RT Herculis	6.8	+27 11	11.2 *i*
U Androm.	1 9.8	+40 11	<12.0	Z Ophiuchi	14.5	+ 1 37	9.8*d*
S Cassiop.	12.3	+72 5	10.2 *i*	RS Herculis	17.5	+23 1	7.8
Y Androm.	33.7	+38 50	9.2	RU Ophiuchi	28.5	+ 9 30	11.8
X Cassiop.	49.8	+58 46	11.2	RT Ophiuchi	51.8	+11 11	<12.0
U Persei	53.0	+54 20	11.2	T Draconis	54.8	+58 14	9.6
R Arietis	2 10.4	+24 35	7.8	RY Herculis	55.4	+19 29	13.2
o Ceti	14.3	− 3 26	9.0	T Herculis	18 5.3	+31 0	9.2 *i*
S Persei	15.7	+58 8	12.4	W Draconis	5.4	+65 56	10.4*d*
W Persei	43.2	+56 34	9.4	RY Ophiuchi	11.6	+ 3 40	9.0
Y Persei	3 20.9	+43 50	10.2	W Lyrae	11.5	+36 38	9.2*d*
W Tauri	4 22.2	+15 49	9.1	X Ophiuchi	33.6	+ 8 44	7.8 *i*
X Camelop.	32.6	+74 56	8.2	RW Lyrae	42.1	+43 32	13.5
S Aurigae	5 20.5	+34 4	9.4	R Aquilae	19 1.6	+ 8 5	9.4 *i*
U Orionis	49.9	+20 10	8.7*d*	R Sagittarii	10.8	−19 29	11.3*d*
R Urs. Maj.	10 37.6	+69 18	11.7*d*	U Lyrae	16.6	+37 42	11.8
T Urs. Maj.	12 31.8	+60 2	12.6*d*	TY Cygni	29.8	+28 6	<11.0
R Virginis	33.4	+ 7 32	10.6*d*	RT Aquilae	33.3	+11 30	8.4
RS Urs. Maj.	34.4	+59 2	10.7*d*	R Cygni	34.1	+49 58	12.0*d*
S Urs. Maj.	39.6	+61 38	8.7 *i*	RV Aquilae	35.9	+ 9 42	11.5*d*
T Urs. Min.	13 32.6	+73 56	<13.0	RT Cygni	40.8	+48 32	8.8 *i*
R Can. Ven.	44.6	+40 2	11.0*d*	TU Cygni	43.3	+48 49	9.8 *i*
U Urs. Min.	14 15.1	+67 15	12.0	X Aquilae	46.5	+ 4 13	11.2*d*
S Bootis	19.5	+54 16	12.0	χ Cygni	46.7	+32 40	9.4 *i*
RS Virginis	22.3	+ 5 8	9.4*d*	Z Cygni	58.6	+49 46	9.2
V Bootis	25.7	+39 18	9.4*d*	SY Aquilae	20 2.3	+12 39	12.0
R Camelop.	25.1	+84 17	<11.0	S Aquilae	7.0	+15 19	9.0
R Bootis	32.8	+27 10	7.4 *i*	RU Aquilae	8.0	+12 42	<12.0
U Bootis	49.7	+18 6	10.6	Z Aquilae	9.8	− 6 27	12.0
S Serpentis	15 17.0	+14 40	8.3	R Delphini	11.1	+ 8 47	8.4 *i*
S Cor. Bor.	17.3	+31 44	12.2*d*	U Cygni	16.5	+47 35	7.0
RS Librae	18.5	−22 33	8.4*d*	RW Cygni	25.2	+39 39	8.6
RU Librae	27.7	−14 59	8.8*d*	ST Cygni	29.9	+54 38	11.6
S Urs. Min.	33.4	+78 58	8.6	T Aquarli	44.7	− 5 31	7.7
X Cor. Bor.	45.2	+36 35	10.6*d*	TW Cygni	21 1.8	+29 0	10.2
R Serpentis	46.1	+15 26	11.2*d*	T Cephei	8.2	+68 5	7.0 *i*
V Cor. Bor.	46.0	+39 52	10.8	S Cephei	36.5	+78 10	10.2
R Herculis	16 1.7	+18 38	12.2*d*	RU Cygni	37.3	+53 52	8.2
U Serpentis	2.5	+10 12	<12.0	V Cassiop.	23 7.4	+59 8	8.8*d*
RU Herculis	6.0	+25 20	13.6	W Pegasi	14.8	+25 44	9.8*d*
W Cor. Bor.	11.8	+38 3	8.0	S Pegasi	15.5	+ 8 22	8.0
V Ophiuchi	21.2	−12 12	8.2	ST Androm.	33.8	+35 13	9.2
U Herculis	21.4	+19 7	11.2*d*	R Cassiop.	53.3	+50 50	7.8
				SV Androm	59.2	+39 33	<12.0

The letter *i* denotes that the light is increasing; the letter *d*, that the light is decreasing; the sign < that the variable is fainter than the appended magnitude.

The above magnitudes have been compiled at the Harvard College Observatory from observations made by the following observers:—H. C. Bancroft, Jr., T. C. H. Bouton, N. Bruseth, S. C. Hunter, H. L. Baldwin, H. O. Eaton, S. H. Huntington, M. W. Jacobs, Jr., J. B. Lacchini, F. C. Leonard, C. B. Lindsley, O. Mach, C. Y. McAteer, C. S. Mundt, W. T. Olcott, C. Richter, F. H. Spinney, D. B. Pickering, H. W. Vrooman, and Miss I. E. Woods.

The following stars are now growing faint and need observations with a large telescope:—

001046	X Androm.	142584	R Camelop
001726	T Androm.	151731	S Cor. Bor.
001838	R Androm.	160118	R Herculis
003179	Y Cephei	160210	U Serpentis
004132	RW Androm.	160625	RU Herculis
004533	RR Androm.	163266	R Draconis
004746	RV Cassiop.	165631	RV Herculis
004958	W Cassiop.	175519	RY Herculis
010940	U Androm.	184243	RW Lyrae
015354	U Persei	*191019*	R Sagittarii
133273	T Urs. Maj.	192928	TY Cygni
140113	Z Bootis	193449	R Cygni
141954	S Bootis	235939	SV Androm.

The following stars are being neglected and need to be followed:—

001909	S Ceti	190967	U Draconis	210812	R Equulei
010102	Z Ceti	*191007*	W Aquilae	*210903*	RR Aquarii
011041	– Androm.	*194929*	RR Sagittarii	220412	T Pegasi
011208	S Piscium	*195202*	RR Aquilae	220613	Y Pegasi
012233a	R Sculptoris	200812	RU Aquilae	220714	RS Pegasi
012350	RZ Persei	*200906*	Z Aquilae	223841	R Lacertae
012502	R Piscium	201130	SX Cygni	*225120*	S Aquarii
021143a	W Androm.	203611	Y Delphini	225914	RW Pegasi
022000	R Ceti	203816	S Delphini	233956	Z Cassiop.
022150	RR Per4ei	*203905*	Y Aquarii	235053	RR Cassiop.
162816	S Ophiuchi	204016	T Delphini	*235209*	V Ceti
183149	SV Draconis	204318	V Delphini	235855	Y Cassiop.
185634	Z Lyrae	210382	X Cephei		

Maxima of Variable Stars of Short Period.

[Calculated by Julia M. Hawkes and May E. Abbott at Goodsell Observatory.]

Given to the nearest hour in Greenwich mean time. To obtain Eastern standard time subtract 5^h; Central standard time 6^h; etc.

Star	R. A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of maxima in 1914 November.
	h m	° ′		d h	d h; d h; d h; d h; d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.4	36 13.7	
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 1.7	6 3; 14 6; 22 9; 30 13
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	5 9; 13 3; 20 22; 28 16
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2	14 17; 29 12
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	3 16; 11 14; 19 13; 27 11
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	11 14; 19 9; 27 4
TU Persei	3 01.8	+52 49	11.4—12.2	0 14.6	6 7; 13 14; 20 21; 28 4
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0	12 28
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	8 8; 16 22; 25 12
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	8 23; 20 2
RX Aurigae	4 54.5	+39 49	7.2— 8.1	11 15.0	6 4; 17 19; 29 10
SX Aurigae	5 04.6	+42 02	8.0— 8.7	1 12.8	4 20; 12 12; 20 4; 27 19
SY Aurigae	05.5	+42 41	8.4— 9.5	10 03.3	1 15; 11 18; 21 21

Maxima of Variable Stars of Short Period.—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of maxima in 1914. November.
	h m	° ′		d h	d h d h d h d h d h
Y Aurigae	21.5	+42 21	8.6— 9.6	3 20.6	8 1; 16 19; 24 12
RZ Gemin.	5 56.6	+22 12	9.1—10.0	5 12.7	4 10; 9 23; 15 11; 21 0
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	1 16; 9 6; 16 19; 24 9
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3	1 12 28 13
RZ Camelop.	23.7	+67 06	11.0—13.0	0 11.5	3 12; 10 17; 17 22; 25 3
W Gemin.	6 29.2	+15 24	6.7— 7.5	7 22.0	1 6; 9 4; 17 2; 25 0
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	2 1; 12 5; 22 8
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5	11 7
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	1 14; 9 12; 17 11; 25 10
V Carinae	8 26.7	−59 47	7.4— 8.1	6 16.7	6 3; 12 19; 19 12; 26 5
T Velorum	8 34.4	−47 01	7.6— 8.5	4 15.3	4 9; 13 15; 22 22
V Velorum	9 19.2	−55 32	7.5— 8.2	4 08.9	4 13; 13 7; 22 1; 30 19
Z Leonis	9 46.4	+27 22	7.9— 9.6	59 0.0	
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	6 6; 13 1; 19 20; 26 15
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	6 9; 12 24; 19 14; 26 5
S Muscae	12 07.4	−69 36	6.4— 7.3	9 15.8	9 18; 19 10; 29 2
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	2 8; 10 7; 18 7; 26 6
T Crucis	15.9	−61 44	6.8— 7.6	6 17.6	4 0; 10 18; 17 11; 24 5
R Crucis	18.1	−61 04	6.8— 7.9	5 19.8	1 16; 7 12; 19 4; 24 23
S Crucis	12 48.4	−57 53	6.5— 7.6	4 16.6	2 1; 6 18; 16 3; 25 12
W Virginis	13 20.9	− 2 52	8.7—10.4	17 06.5	8 17; 25 23
SS Hydrae	25.0	−23 08	7.4— 8.1	8 4.8	8 14; 16 19; 25 00
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	1 2; 8 3; 15 3; 22 4
ST Virginis	14 22.5	− 0 27	10.3—11.4	0 09.9	5 4; 13 9; 21 14; 29 19
V Centauri	25.4	−56 27	6.4— 7.8	5 11.9	5 13; 11 1; 16 13; 22 1
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	2 7; 9 20; 17 9; 24 22
RU Bootis	14 41.5	+23 44	12.8—14.3	0 11.9	1 1; 8 11; 15 21; 23 6
R Triang. Austr.	15 10.8	−66 08	6.7— 7.4	3 09.3	7 14; 14 9; 21 4; 27 22
S Triang. Austr.	15 52.2	−63 29	6.4— 7.4	6 07.8	5 7; 11 15; 17 23; 24 7
S Normae	16 10.6	−57 39	6.6— 7.6	9 18.1	5 2; 14 20; 24 14
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	8 20; 17 16; 26 13
RV Scorpii	16 51.8	−33 27	6.7— 7.4	6 01.5	2 14; 8 15; 14 17; 20 19
X Sagittarii	17 41.3	−27 48	4.4— 5.0	7 00.3	3 2; 10 2; 17 2; 24 3
Y Ophiuchi	47.3	− 6 07	6.1— 6.5	17 02.9	2 1; 19 4
W Sagittarii	17 58.6	−29 35	4.3— 5.1	7 14.3	1 13; 9 3; 16 18; 24 8
Y Sagittarii	18 15.5	−18 54	5.4— 6.2	5 18.6	3 5; 8 23; 14 18; 20 13
U Sagittarii	26.0	−19 12	6.5— 7.3	6 17.9	1 19; 8 13; 15 7; 22 0
Y Scuti	32.6	− 8 27	8.7— 9.2	10 08.3	8 17; 19 1; 29 10
Y Lyrae	34.2	+43 52	11.3—12.3	0 12.1	4 8; 10 9; 16 9; 22 10
RZ Lyrae	39.9	+32 42	9.9—11.2	0 12.3	1 22; 7 5; 13 8; 19 11
RT Scuti	44.1	−10 30	9.1— 9.7	0 11.9	4 5; 10 4; 16 3; 22 2
κ Pavonis	18 46.6	−67 22	3.8— 5.2	9 02.2	1 21; 10 23; 20 1; 29 4
U Aquilae	19 24.0	− 7 15	6.2— 6.9	7 00.6	2 6; 9 6; 16 7; 23 7
XZ Cygni	30.4	+56 10	8.6— 9.3	0 11.2	4 9; 11 9; 18 9; 25 9
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	3 16; 11 15; 19 15; 27 14
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	3 10; 11 2; 18 19; 26 12
η Aquilae	47.4	+ 0 45	3.7— 4.5	7 04.2	2 3; 9 8; 26 12; 23 16
S Sagittae	51.5	+16 22	5.6— 6.4	8 09.2	6 6; 14 16; 23 1
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	3 8; 9 16; 15 23; 22 7
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	10 23; 27 8
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	4 2; 8 13; 17 10; 26 7
WY Cygni	52.3	+30 03	9.6—10.4	0 13.5	5 3; 11 21; 18 14; 25 8
RV Capric.	55.9	−15 37	9.2—10.1	0 10.7	5 12; 12 5; 18 22; 25 16
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	7 15; 22 9
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	5 1; 12 22; 20 18; 28 15
SW Aquarii	10.2	− 0 20	9.9—10.8	0 11.0	7 5; 14 3; 20 24; 27 21
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	5 1; 8 22; 19 15; 24 12
Y Lacertae	22 05.2	+50 33	9.1— 9.6	4 07.8	1 16; 6 15; 16 15; 26 14
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	5 4; 10 14; 16 1; 21 12
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	5 19; 10 19; 20 18; 25 18

Minima of Variable Stars of Short Period.

[Calculated by May E. Abbott, at Goodsell Observatory.]

Given to the nearest hour in Greenwich mean time; to obtain Eastern Standard time subtract 5h; Central Standard 6h; etc.

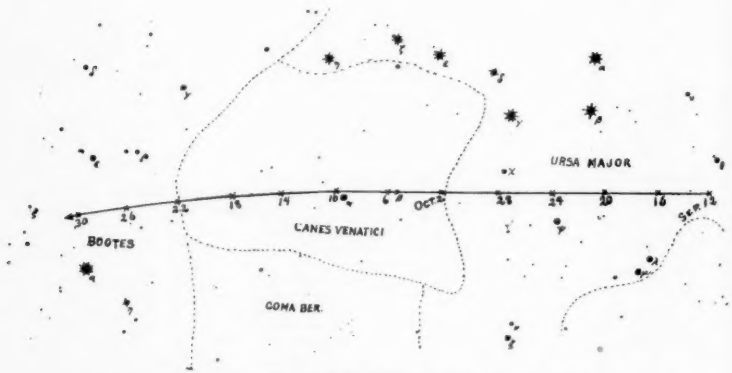
Star	R. A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of minima in 1914 November.							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8			12 11					
RT Sculptor.	31.5	−26 13	9.6—10.5	0 12.3	6 2;	13 19;	21 11;	29 3				
UU Androm.	38.5	+30 24	10.7—11.9	1 11.7	7 1;	14 12;	21 22;	29 8				
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	7 11;	14 23;	22 10;	29 22				
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	4 14;	10 16;	16 19;	22 22				
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	3 16;	10 20;	17 23;	25 2				
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	3 12;	10 9;	17 6;	24 3				
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	4 14;	11 18;	18 22;	26 2				
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	2 23;	11 18;	20 12;	29 7				
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	5 2;	13 1;	20 24;	28 22				
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6		14 20						
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	3 19;	9 13;	15 7;	21 0				
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	7 18;	14 13;	21 8;	28 4				
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	2 11;	10 9;	18 6;	26 4				
RW Tauri	3 57.8	+27 51	7.1—<11	2 18.5	3 19;	12 2;	20 10;	28 17				
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	8 4;	16 1;	23 23					
RW Persei	13.3	+42 04	8.8—11.0	15 04.8	3 11;	16 16;	29 21					
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	9 7;	18 18;	28 4					
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	7 5;	19 15						
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	1 15;	8 7;	14 23;	21 15				
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	3 15;	9 3;	20 0;	25 11				
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	5 21;	11 21;	17 22;	23 22				
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	5 21;	14 13;	23 5					
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	3 5;	13 14;	24 0					
SV Gemin.	54.6	+24 28	9.8—<11	4 00.2	4 14;	12 14;	20 14;	28 15				
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	6 5;	11 22;	17 16;	23 9				
U Columbae	6 11.2	−33 03	9.2—10.0	2 19.2	2 0;	7 15;	18 19;	24 10				
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	2 5;	10 10;	18 14;	26 19				
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	3 15;	11 6;	18 21;	26 12				
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0		11 7;	23 12					
RU Monoc.	6 49.4	− 7 28	9.8—10.5	0 21.5	3 3;	10 7;	17 11;	24 15				
R Can. Maj.	7 14.9	−16 12	5.8— 6.4	1 03.3	1 1;	10 3;	19 5;	28 7				
RY Gemin.	21.7	+15 52	8.9—<10	9 07.2	5 18;	15 1;	24 9					
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	4 15;	14 13;	24 11					
TX Gemin.	30.3	+17 8	10.0—11.9	2 19.2	7 20;	16 5;	24 14					
RR Puppis	43.5	−41 08	9.4—10.7	6 10.3	5 11;	11 22;	18 9;	24 18				
V Puppis	7 55.4	−48 58	4.1— 4.8	1 10.9	2 3;	9 10;	16 16;	23 23				
X Carinae	8 29.1	−58 53	7.9— 8.7	0 13.0	8 3;	16 6;	24 9					
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	7 1;	16 12;	25 24					
RX Hydrae	9 0.8	− 7 52	9.1—10.5	2 6.8	7 16;	16 19;	25 22					
S Antliae	27.9	−28 11	6.3— 6.8	0 07.8	3 16;	10 4;	16 15;	23 3				
S Velorum	29.4	−44 46	7.8— 9.3	5 22.4	1 12;	7 11;	13 9;	19 8				
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	3 11;	11 21;	20 8;	28 18				
RR Velorum	10 17.8	−41 36	10.0—10.9	1 20.5	8 11;	17 18;	27 0					
SS Carinae	10 54.2	−61 23	12.2—12.8	3 07.2	1 13;	8 3;	14 17;	21 8				
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	9 14;	18 10;	27 5					
RW Urs. Maj.	35.4	−52 34	10.3—11.4	7 07.9	1 9;	8 17;	16 1;	23 9				
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	1 8;	8 3;	14 22;	21 17				
RZ Centauri	12 55.6	−64 05	8.5— 8.9	1 21.0	4 13;	12 1;	19 13;	26 1				
SS Centauri	13 07.2	−63 37	8.8—10.4	2 11.5	1 5;	8 15;	16 2;	23 12				
δ Librae	14 55.6	− 8 07	4.8— 6.2	2 07.9	6 13;	13 12;	20 12;	27 11				
U Coronae	15 14.1	+32 01	7.6— 8.7	3 10.9	4 20;	11 18;	18 16;	25 13				
TW Draconis	32.4	+64 14	7.3— 8.9	2 19.4	1 20;	10 6;	18 16;	27 2				
SS Librae	15 43.4	−15 14	9.3—11.5	0 18.4	6 0;	13 16;	21 8;	28 24				

Minima of Variable Stars of Short Period.—Continued.

Star	R. A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of minima in 1914 November.							
	h m	° ′		d h	d	h	d	h	d	h	d	h
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	2	11;	8	19;	16	3;	23	11
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	5	0;	13	6;	12	12;	29	18
R Arae	31.1	—56 48	6.8— 7.9	4 10.2	4	15;	13	11;	22	8		
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1			10	6;	19	23;	23	0
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	4	2;	10	22;	17	17;	24	12
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	0 20.1	6	18;	15	4;	23	13		
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	4	13;	10	17;	16	21;	23	0
TX Herculis	15.4	+42 00	8.3— 9.0	1 00.7	1	2;	8	8;	15	13;	22	18
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	2	10;	9	19;	17	4;	24	13
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	5	7;	13	11;	21	15;	29	20
TX Scorpii	48.6	—34 13	7.5— 8.2	0 22.6	2	10;	9	23;	17	13;	25	1
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	6	8;	14	2;	21	20;	29	14
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	8	0;	15	24;	23	23		
WX Sagittae	53.6	—17 24	9.2—10.8	2 03.1	4	16;	13	4;	21	17;	30	5
WY Sagittae	17 54.9	—23 1	9.5—10.6	4 16.0	6	1;	15	9;	24	17		
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	3	22;	14	6;	24	15		
RS Sagittarii	11.0	—34 08	5.9— 6.3	2 10.0	6	22;	14	4;	21	10;	28	16
V Serpentis	11.1	—15 34	9.5—11.1	3 10.9	2	2;	9	0;	15	22;	22	20
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2	4	10;	19	13				
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	5	12;	13	19;	22	1;	30	7
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	7	17;	16	15;	25	12		
SX Sagittarii	39.7	—30 36	8.7— 9.8	2 01.8	3	16;	11	24;	20	7;	28	14
RR Draconis	40.8	+62 34	9.3—13	2 19.9	3	23;	12	11;	20	23;	29	10
RS Scuti	43.7	—10 21	9.3—10.3	0 15.9	3	1;	9	17;	16	8;	22	24
β Lyrae	46.4	+33 15	3.4— 4.1	12 21.8	6	21;	19	19				
U Scuti	18 48.9	—12 44	9.1— 9.6	0 22.9	8	14;	18	3;	27	17		
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	5	12;	13	2;	20	16;	28	6
RV Lyrae	12.5	+32 15	11. —12.8	3 14.4	7	21;	15	2;	22	7;	29	11
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	8	4;	17	3;	26	2		
U Sagittae	14.4	+19 26	6.5— 9.0	3 09.1	3	1;	9	19;	16	13;	23	7
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	1	7;	8	16;	16	0;	23	9
TT Lyrae	24.3	+41 30	9.3—11.6	5 05.8	3	24;	9	6;	19	17;	24	23
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	6	12;	13	1;	19	13;	26	2
SY Cygni	19 42.7	+32 28	10 —12	6 00.2	3	21;	9	21;	15	21;	21	22
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	1	9;	7	24;	14	15;	21	6
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	2	4;	11	8;	20	11;	29	15
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	8	18;	17	5;	25	15		
RW Capric.	12.2	—17 59	8.8—10.6	3 09.4	7	5;	13	24;	20	19;	27	13
UW Cygni	19.6	+42 55	10.5—13	3 10.8	1	23;	8	21;	15	19;	22	16
V Vulpec.	32.3	+26 15	8.2—9.8	37 19.0			17	22				
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	5	12;	15	3;	24	18		
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	9	6;	18	11;	27	16		
Y Cygni	48.1	+34 17	7.1— 7.9	1 12.0	7	18;	15	6;	22	18;	30	6
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	5	5;	11	1;	16	21;	22	18
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	1	19;	11	22;	22	0		
VV Cygni	21 02.3	+45 23	12.1—13.8	1 11.4	1	20;	9	6;	16	15;	24	0
AE Cygni	09.0	+30 20	10.8—11.4	0 23.3	6	19;	16	11;	26	4		
RY Aquarii	14.8	—11 14	8.8—10.4	1 23.2	3	17;	11	14;	19	10;	27	7
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3			2	8				
RT Lacertae	21 57.4	+43 24	9.1—10.5	5 01.7	2	0;	12	4;	22	7		
RW Lacertae	22 40.6	+49 08	10.2—11.2	5 04.4	3	24;	9	4;	19	12;	24	17
X Lacertae	22 45.0	+55 54	8.2— 8.6	5 10.6	7	6;	12	16;	18	3;	23	13
TT Androm.	23 08.7	+45 36	11.3—12.6	2 18.3	5	10;	13	17;	21	24;	30	7
Y Piscium	29.3	+ 7 22	9.0—12.0	3 18.4	8	11;	15	24;	23	13		
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	5	23;	14	5;	22	11;	30	16

COMET AND ASTEROID NOTES.

Comet *f* 1913 (Delavan).—This comet is fulfilling the predictions which were made concerning it nearly a year ago and has become visible to the naked eye. On the morning of September 4 it was visible to the eye in moonlight, being then not far from the stars κ and ι in the fore paw of Ursa Major and nearly equal to κ in brightness. On September 11 it could be easily seen near the north horizon in the evening and small field glasses made its cometary character evident, showing about two degrees length of tail. The accompanying chart shows the apparent path of the comet among the stars from September 12 to October 30. On clear nights when the moonlight is absent the comet will be an object well worth looking



APPARENT COURSE OF COMET *f* 1913 (DELAVAN) AMONG THE STARS.

at with small telescopes. Its course during October lies through the constellation Canes Venatici, below the tail of the Great Bear, into the constellation Bootes, ending the month at a point about 5° northeast of Arcturus. Unfortunately this region of the sky is low, near the northern horizon, in the early evening, so that one must get up in the morning to see the comet at its best. Between three and four o'clock in the morning is the best hour to view it, when it is seen toward the northeast nearly half way up to the zenith.

The chart was constructed from the following ephemeris, sent us early in the summer by G. Van Biesbroeck of the Brussels observatory. This ephemeris is quite exact out to the lowest figures given, the observed position September 4 indicating the corrections $\Delta\alpha = -0^m.2$, $\Delta\delta = +0'.4$

EPHEMERIS OF COMET *f* 1913 DELAVAN.

For Berlin Midnight.

		h	m	°	′	m
Aug.	15	6	55.3	+43	45	5.8
	19	7	12.9		45	6	5.7
	23	7	32.2		46	21	5.5
	27	7	53.5		47	32	5.4
	31	8	16.9		48	32	5.3
Sept.	4	8	42.4		49	20	5.2
	8	9	9.9			51	5.0
	12	9	39.0			59	4.9
	16	10	9.4		49	43	4.8
	20	10	40.2		48	58	4.7
	24	11	10.7		47	44	4.6
	28	11	40.1		46	2	4.6
Oct.	2	12	7.9		43	54	4.5
	6	12	33.7		41	25	4.5
	10	12	57.3		38	40	4.5
	14	13	18.8		35	43	4.4
	18	13	38.3		32	49	4.5
	22	13	56.0		29	33	4.5
	26	14	12.0		26	27	4.5
	30	14	26.6	+23	25	4.6

G. VAN BIESBROECK.
Uccle.

Ephemeris of Comet *f* 1913 (Delavan).—The following, from the *Lick Observatory Bulletin*, is sent us in advance by the kindness of Professor A. O. Leuschner, director of the Student's Observatory of the Berkeley Astronomical Department,

In *A. N.* No. 4751, Professor Kobold publishes comparisons of an observation of comet *f* 1913 (Delavan), taken at Algiers on July 4, with the parabolic orbit by G. Van Biesbroeck (*A. N.* No. 4739), the elliptic orbit by E. E. Kühne (*A. N.* 4739), and the hyperbolic orbit by S. B. Nicholson and C. D. Shane (Bulletin No. 255). Since Professor Kobold failed to publish a comparison with the parabolic orbit published by Messrs. Nicholson and Shane (Bulletin 255), we have compared an observation taken on Mount Hamilton by Nicholson on July 4, the date of the Algiers observation, with this parabolic orbit. The collected residuals for the Algiers and Lick observations are as follows:

Observation	Cos δ. Δα	Δδ	Orbit
Algiers, July 4	−0ˢ.62	+3″.4	Parabola, G. Van Biesbroeck. From normal places, 1913 Dec. 19, 1914 Feb. 2, March 26.
" "	+10ˢ.	+36″.	Ellipse, E. E. Kuehne. From normal places, 1913 Dec. 23, 1914 Jan. 24, Feb. 13, Mar. 21, Apr. 6.
Mount Hamilton, July 4	−8ˢ.9	−101″	Hyperbola, S. B. Nicholson and C. D. Shane. From normal places 1913 Dec. 18, 1914, Jan. 31, Mar. 15.
" "	+0ˢ.21	−2″.1	Parabola, S. B. Nicholson and C. D. Shane. From normal places 1913, Dec. 18, 1914 Jan. 13, Mar. 15.

It would therefore appear that the parabolic orbit by Nicholson and Shane represents at least as well as the parabolic orbit by Van Biesbroeck. The hyperbolic was published in greater detail than the parabolic ephemeris, because the parabolic residual $\Delta\delta = +14.''3$ appeared inconsistent with the supposed accuracy of the normal places.

As the comet is now visible to the naked eye, it will readily be picked up on the basis of the following extension of the parabolic ephemeris by Messrs. Nicholson and Shane.

EPHEMERIS FOR GREENWICH MEAN MIDNIGHT.

1914	True α h m s	True δ ° ′ ″	log Δ	Aber. T.	Br.
Sept. 3.5	8 35 53.0	+49 11 09			
5.5	8 49 08.8	49 31 04			
7.5	9 02 53.9	49 46 21	0.2436	—0.01011	31.66
9.5	9 17 06.1	49 56 28			
11.5	9 31 42.1	50 00 56			
13.5	9 46 38.1	49 59 13			
15.5	10 01 49.2	49 50 55	0.2215	0.00961	38.88
17.5	10 17 10.1	49 35 40			
19.5	10 32 35.1	49 13 16			
21.5	10 47 58.0	48 43 34			
23.5	11 03 13.2	48 06 34	0.2060	0.00928	45.95
25.5	11 18 14.8	47 22 24			
27.5	11 32 57.9	46 31 18			
Sept. 29.5	11 47 18.2	45 33 36			
Oct. 1.5	12 01 12.2	44 29 46	0.1986	0.00912	51.66
3.5	12 14 37.1	43 20 20			
5.5	12 27 31.0	42 05 51			
7.5	12 39 53.0	40 46 46			
9.5	12 51 42.4	39 24 14	0.1999	0.00915	54.84
11.5	13 02 59.6	37 58 21			
13.5	13 13 45.0	36 29 56			
15.5	13 23 59.5	34 59 32			
17.5	13 33 44.4	33 27 44	0.2090	0.00934	54.90
19.5	13 43 01.0	31 55 01			
21.5	13 51 50.8	30 21 52			
23.5	14 00 15.2	28 48 40			
25.5	14 08 15.8	27 15 49	0.2240	0.00967	52.09
27.5	14 15 54.2	25 43 35			
29.5	14 23 11.8	24 12 14			
Oct. 31.5	14 30 10.1	22 42 01			
Nov. 2.5	14 36 50.5	21 13 05	0.2426	0.01009	47.27
4.5	14 43 14.2	19 45 37			
6.5	14 49 22.6	18 19 42			
8.5	14 55 16.7	16 55 29			
10.5	15 00 57.6	15 33 00	0.2628	0.01057	41.48
12.5	15 06 26.3	14 12 18			
14.5	15 11 43.6	12 53 24			
16.5	15 16 50.5	11 36 22			
18.5	15 21 47.6	10 21 10	0.2829	0.01107	35.58
20.5	15 26 35.5	09 07 47			
22.5	15 31 15.0	07 56 13			
24.5	15 35 46.7	06 46 26			
26.5	15 40 10.9	05 38 23	0.3017	0.01156	30.11
28.5	15 44 28.3	04 32 01			
Nov. 30.5	15 48 39.3	03 27 20			
Dec. 2.5	15 52 38.2	02 24 15			
Dec. 4.5	15 56 43.6	+01 22 43	0.3186	—0.01202	25.37

Brightness 1914 March 1 = 1.00.

The correction to this ephemeris from observations taken at Mount Hamilton by Messrs. Nicholson and Shane on August 21 is

$$\text{Cos } \delta.\Delta\alpha = +4^s.6 \quad \Delta\delta = -21''$$

S. EINARSSON.
J. IRENE MACKAY.

Berkeley Astronomical Department.
September 18, 1914.

Elements and Ephemeris of Comet *c* 1914 (Neujmin).—The following elements and ephemeris are taken from the *Lick Observatory Bulletin* No. 260 and were computed by R. T. Crawford and C. D. Shane, of the Berkeley Astronomical Department. They depend upon three observations by Professor Aitken at the Lick Observatory on the dates July 2, 16 and 30.

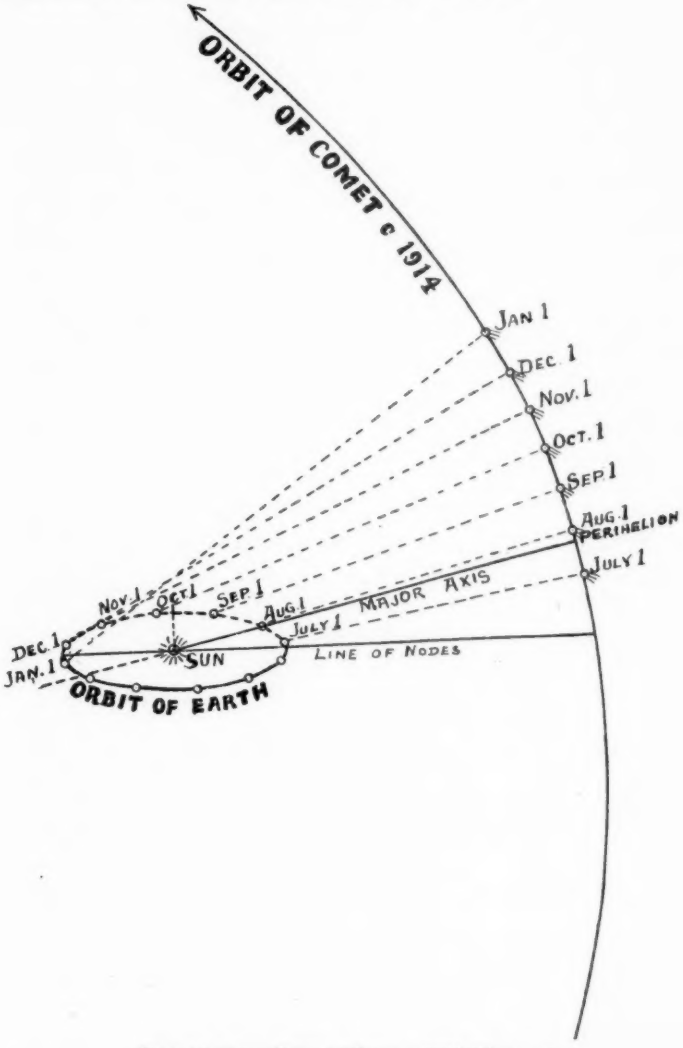


DIAGRAM OF THE ORBIT OF COMET *c* 1914 (NEUJMIN).

ELEMENTS.

$$\begin{aligned} T &= 1914\ \text{July}\ 24.65165\ \text{Gr. M. T.} \\ \omega &= 12^\circ\ 58'\ 56''.2 \\ \Omega &= 272\ \ 18\ \ 49\ \ .1 \quad 1914.0 \\ i &= 71\ \ 01\ \ 06\ \ .5 \\ \log q &= 0.573206 \end{aligned}$$

It is stated by the computers that "on account of the slow heliocentric motion this comet can probably be observed with large telescopes for several months..... In January, 1915, the comet will be in conjunction with the sun."

Only the portion of the ephemeris covering the remainder of the year is here given. The comet is small and probably cannot be picked up with small telescopes.

EPHEMERIS.

1914	True α	True δ	log Δ	Br.
	h m s	° ′ ″		
Oct. 1.5	17 34 45.5	+0 34 34		
3.5	35 44.9	43 18	0.5945	0.48
5.5	36 47.3	0 51 58		
7.5	37 52.5	1 00 36		
9.5	39 00.5	09 13		
11.5	40 11.2	17 46	0.6075	0.45
13.5	41 24.6	26 20		
15.5	42 40.5	34 56		
17.5	43 58.9	43 34		
19.5	45 19.7	1 52 14	0.6195	0.42
21.5	46 42.8	2 00 58		
23.5	48 08.2	09 47		
25.5	49 35.8	18 41		
27.5	51 05.4	27 42	0.6305	0.40
29.5	52 37.0	36 50		
Oct. 31.5	54 10.6	46 06		
Nov. 2.5	55 46.0	2 55 30		
4.5	57 23.2	3 05 03	0.6404	0.38
6.5	17 59 02.1	14 46		
8.5	18 00 42.7	24 39		
10.5	02 24.9	34 43		
12.5	04 08.6	45 00	0.6493	0.36
14.5	05 53.8	3 55 29		
16.5	07 40.4	4 06 10		
18.5	09 28.3	17 05		
20.5	11 17.5	28 15	0.6570	0.34
22.5	13 07.9	39 39		
24.5	14 59.5	4 51 19		
26.5	16 52.2	5 03 14		
28.5	18 45.8	15 26	0.6637	0.33
Nov. 30.5	20 40.4	27 54		
Dec. 2.5	22 35.9	40 40		
4.5	24 32.2	5 53 43		
6.5	26 29.4	6 07 05	0.6694	0.32
8.5	28 27.3	20 45		
10.5	30 25.9	34 44		
12.5	32 25.1	6 49 02		
14.5	34 24.9	7 03 39	0.6740	0.31
16.5	36 25.2	18 37		
18.5	38 26.0	33 55		
20.5	40 27.2	7 39 34		
22.5	42 28.7	8 05 35	0.6777	0.30
24.5	44 30.5	21 57		
26.5	46 32.5	38 41		
28.5	48 34.7	8 55 47		
Dec. 30.5	18 50 36.9	+9 13 14	0.6804	0.29

Brightness July 2 = 1.00.

Comet *f* 1913 Delavan.—I wish to report that I observed comet *f* 1913 (Delavan), 1914 Aug. 15^d 15^h. It was plainly visible in a 2-inch telescope, showing considerable central condensation and a tail about 30′ in length, extending away to the southwest. A small star was plainly visible through the tail.

WM. H. CASSELL.

Wytheville, Va. 1914, Aug. 16.

Encke's Comet Rediscovered.—A telegram from Yerkes Observatory, distributed from Harvard College Observatory September 19, states that Encke's comet was photographed by Barnard September 17.76 (Greenwich mean time) ascension 3^h 43^m 46^s, north 37° 56′.

New Bright Comet in Doradus.—The same announcement from Harvard states that Campbell of Arequipa cables bright comet seen in Doradus. The constellation Doradus or Dorado is in the southern sky, invisible in the United States.

Elements of Asteroid (776) TY.—The following elements of asteroid 776 (TY) are based upon observations made at the Collegio Romano in Rome, and published in one of the latest Nachrichtens (No. 4747). The formulae all check to seven place decimals.

ELEMENTS OF ASTEROID 776 TY.

$$\begin{aligned}
\text{Epoch} &= \text{March } 29.500\ 1914\ \text{G.M.T.}\\
M &= 105^\circ\ 7'\ 27''.72\\
\omega &= 305\ \ 33\ \ 20\ .69\\
\Omega &= \ 79\ \ 35\ \ 51\ .02\\
i &= \ 18\ \ \ 0\ \ 55\ .91\\
\log e &= 9.1336686\\
\log a &= 0.4659298\\
\log q &= 0.4024231\\
\mu &= 709.''7606
\end{aligned}$$

$$\begin{aligned}
x &= r\,[9.9789156]\ \sin\,(169^\circ\ 4'\ 25''.71 + u)\\
y &= r\,[9.9556718]\ \sin\,(\ 87\ 48\ \ 52\ .10 + u)\\
z &= r\,[9.7213838]\ \sin\,(\ 48\ \ 1\ \ 56\ .59 + u)
\end{aligned}$$

F. E. SEAGRAVE.

Boston, Aug. 27, 1914.

NOTES FOR OBSERVERS.

Monthly Report of the American Association of Variable Star Observers, July, August, September, 1914.—In spite of the vacation season with its many distractions, our observers in the aggregate have made a very good showing during the past two months.

The steady growth in the membership of the Association is most gratifying. It is a pleasure to welcome as new members the following observers:

Mr. David P. Pickering, "Pi" East Orange, N. J. 3½″.
Mr. David M. Brunswick, "Bk" Gloucester, Mass. 3″.
Mr. Ralph S. Damon, "Da" Pascoag, R. I.
Mr. Francis H. Hay, "Hy" Los Angeles, Cal.

Mr. Lindsley and Mr. Richter are the leaders as regards the number of observations contributed during the past two months. For July, the former sent in 279 observations. Thanks are due Mr. Lindsley for many fine blue prints for distribution. For August, Mr. Richter contributed 236 estimates, not including a number of observations of Beta Lyrae, and Delta Cephei, Mr. Richter deserves great credit for making many early morning observations which are of special value.

Mr. Baldwin, a new member, deserves mention for his good list of 182 observations, and for special observations of a suspected variable.

Observers who have the chart of 124204 RU Virginis please note that the magnitudes of the comparison stars 10.6 and 10.3 are interchanged.

For fine examples of coöperative observing note the work of our members in two months on such variables as 154428 R Cor. Bor., *184205* R Scuti, 202946 SZ Cygni, 213843 SS Cygni, and many others. Will members please endeavor to correct mistakes of misidentification as revealed by marked discordance in many of the observations? The discordant estimates are published in order that the observers may note for themselves where their estimates fail of agreement. More care in this regard is advisable.

Mr. Leon Campbell, of the H. C. O. Observatory Station at Arequipa, Peru, who is keenly interested in the welfare of the association, suggests that, in order to render the reports of greater service to observers who are discussing the observations, the time of the observations expressed in tenths of a day G. M. T. be given in the case of the following variables:

060547 SS Aurigae, 064932 Nova Geminorum No. II, 074922 U Geminorum, *184205* R Scuti, 154428 R Cor. Bor. and 213843 SS Cygni. Members are requested to act on this suggestion in making out their lists in the future.

The report includes the observation of two maxima of the variable 213843 SS Cygni, both of which were well observed. An interesting observation of this star was made by several observers about July 26, when the variable rose to approximately 10.5 magnitude and then rapidly waned to its normal minimum. This phenomena was observed ten years ago, and the following comparison may be of interest:

1904 J. D.	Interval from date of max.	Mag.	1914 J. D.	Interval from date of max.	Mag.
6787		8.4	0317		8.1
	16 days			17 days	
6803		12.1	0334		11.9
	36 days			23 days	
6823		10.9	0340		10.7
	42 days			26 days	
6829		12.0	0343		11.9

VARIABLE STAR OBSERVATIONS July, August and September 1914.

001726
T Androm.

Mo.	Day	Est.	Obs.
7	28	13.0	E

001755
T Cassiopeiæ

Mo.	Day	Est.	Obs.
7	3	12.0	M
	17	11.6	M
	19	12.4	J
8	19	10.2	Bl
	23	11.3	Sp
	24	11.3	Sp
	26	11.4	Sp
	27	10.5	O
	30	10.1	Bl

001838
R Androm.

Mo.	Day	Est.	Obs.
7	4	9.6	Ly
	18	9.7	Ly
	19	9.7	P
	24	10.3	Ly
	28	9.8	Ly
	28	10.6	E
8	4	9.9	Ly
	9	10.3	Ly
	15	10.9	Ly
	17	11.4	Ba

004047
U Cassiop.

Mo.	Day	Est.	Obs.
8	21	12.8	E

004132
RW Androm.

Mo.	Day	Est.	Obs.
7	19	10.7	J
	28	11.0	E
8	17	12.0	Ba

004435
V Androm.

Mo.	Day	Est.	Obs.
7	19	9.6	M
8	17	10.5	Ba
	19	9.9	Bl
	23	10.8	M

004533
RR Androm.

Mo.	Day	Est.	Obs.
7	19	9.0	M

004746
RV Cassiop.

Mo.	Day	Est.	Obs.
7	29	10.7	Ba

004958
W Cassiop.

Mo.	Day	Est.	Obs.
6	27	9.4	Br
7	18	10.0	J
	29	10.2	Ba
8	16	10.2	Ba
	19	10.2	Bl
	21	10.6	E
	23	11.0	Sp
	24	11.1	Sp
	26	11.1	Sp
	27	11.0	O

101272
S Cassiop.

Mo.	Day	Est.	Obs.
8	21	12.3	E
	23	10.5	M

013238
RU Androm.

Mo.	Day	Est.	Obs.
7	19	10.1	J

013338
Y Androm.

Mo.	Day	Est.	Obs.
7	19	9.7	J
8	17	9.5	Ba

014958
X Cassiop.

Mo.	Day	Est.	Obs.
8	6	11.6	M
	19	11.4	M
	22	11.1	M

015354
U Persei

Mo.	Day	Est.	Obs.
7	4	9.3	Ly
	18	9.5	Ly
	19	9.3	M
	28	10.0	Ly
	28	9.9	Bl
8	9	10.4	Ly
	13	9.8	Bl
	15	10.7	Ly
	18	10.9	Ly
	21	10.0	Bl
	21	11.0	Ly
	27	10.1	E

021024
R Arietis

Mo.	Day	Est.	Obs.
7	19	9.9	P
	28	9.3	Bl
8	13	8.5	Bl
	15	8.2	Pi
	19	8.0	M
	19	8.0	Bl
	30	7.4	Bl

021403
o Ceti

Mo.	Day	Est.	Obs.
7	19	7.8	L
	28	8.3	Bl
	31	8.2	L
8	18	8.6	L
	19	8.6	Bl
	26	9.1	R
	30	8.8	Bl

021658
S Persei

Mo.	Day	Est.	Obs.
7	18	9.5	Ly
8	24	12.4	Sp
	26	12.4	Sp

022813
U Ceti

Mo.	Day	Est.	Obs.
7	31	8.4	L
8	18	8.8	L

023133
R Triang.

Mo.	Day	Est.	Obs.
8	22	7.7	Le

024356
W Persei

Mo.	Day	Est.	Obs.
7	1	9.5	L
	4	9.4	Ly
	18	9.3	Ly
	19	9.4	L
	19	9.5	M
	26	9.4	M
	28	9.9	Bl
	28	9.5	Ly
	28	9.3	Le
	29	9.1	Ba
8	4	9.6	Ly
	7	9.3	Ly
	13	9.3	Bl
	15	9.7	Pi
	15	9.2	Ly
	19	9.8	M
	21	9.2	Bl
	22	9.8	Ma
	22	9.4	Ly
	26	9.3	Ly
	28	9.2	Ly
	30	10.0	Bl

032043
Y Persei

Mo.	Day	Est.	Obs.
7	18	9.7	Ly
	19	9.7	M
	28	10.1	Bl
	28	9.7	Ly
8	9	9.6	Ly
	13	10.0	Bl
	15	9.5	Ly
	21	10.3	Bl
	22	10.0	M
	23	10.0	Ly
	27	10.4	E

033362
U Camelop.

Mo.	Day	Est.	Obs.
7	16	8.1	Ly
	28	7.3	Le
	29	8.2	Ly
8	4	8.4	Ly
	9	8.7	Ly
	15	9.2	Ly
	20	8.6	M
	22	8.3	Ly

035915
V Eridani

Mo.	Day	Est.	Obs.
8	19	8.8	Bl
	30	8.9	Bl

042215
W Tauri

Mo.	Day	Est.	Obs.
7	28	10.6	Bl
8	18	9.7	M
	19	9.5	Bl
	30	9.0	Bl

043065
T Camelop.

Mo.	Day	Est.	Obs.
8	13	10.9	Bl

043274
X Camelop.

Mo.	Day	Est.	Obs.
7	19	12.0	L
	24	11.2	Ly
	24	11.9	L
	28	11.1	Ly
	31	10.7	Ly
	31	11.7	L
8	9	9.1	Ly
	11	9.6	L
	13	8.9	Bl
	13	9.0	L
	15	8.5	Ly
	19	8.8	Bl
	23	8.4	Ly
	26	8.2	Ly

045514
R Leporis

Mo.	Day	Est.	Obs.
8	18	6.8	R

052034
S Aurigæ

Mo.	Day	Est.	Obs.
7	19	9.4	L
	31	9.7	L
8	18	9.9	L
	18	9.2	M
	21	9.5	M

054920
U Orionis

Mo.	Day	Est.	Obs.
7	3	7.0	Bb
	31	7.8	L
8	18	8.5	L

060450
X Aurigae

Mo.	Day	Est.	Obs.
7	19	8.8	L
	31	8.5	L

063558
S Lyncis

Mo.	Day	Est.	Obs.
7	3	10.8	Bb

093934
R Leo. Min.

Mo.	Day	Est.	Obs.
7	2	11.2	Ly

094211
R Leonis

Mo.	Day	Est.	Obs.
6	24	10.0	R
7	2	9.4	Ly
	3	10.3	Bb
	4	10.4	Bu
	6	9.5	Ly

095421
V Leonis

Mo.	Day	Est.	Obs.
7	3	9.7	Bb
	4	9.8	Bu
	7	9.9	Bb

103769
R Urs. Maj.

Mo.	Day	Est.	Obs.
6	24	9.0	R
	24	8.9	R
7	1	8.7	L
	1	9.0	Bu
	2	9.0	Ly
	4	9.4	Bu
	6	9.4	Ly
	7	9.5	Bb
	8	9.7	R
	9	9.7	Bl
	10	9.5	M
	11	9.6	Bu
	13	9.1	G
	14	9.8	Ly
	14	9.8	L
	17	9.8	Ba
	17	10.2	Bl
	18	9.8	O
	18	10.0	Ly
	19	9.8	M
	19	9.9	J
	20	9.8	Bu
	21	10.1	B
	24	10.3	Ly
	26	9.9	M
	26	10.5	O
	27	10.2	Bu
	28	10.3	Ba
	28	9.9	M
	28	10.3	L
	31	10.6	G
8	2	10.5	Ly
	11	11.1	L
	11	10.7	Ly
	14	11.3	Ba

115919
R Comae

Mo.	Day	Est.	Obs.
7	1	8.0	Bu
	3	8.1	Bb
	4	8.2	Bu
	8	8.0	R
	11	8.2	Bu
	11	7.9	R
	12	8.1	R
	13	8.1	R
	20	8.2	Bu
	20	8.1	R

120012
SU Virginis

Mo.	Day	Est.	Obs.
7	1	11.2	Bu
	4	11.0	Bu
	11	10.8	Bu
	18	10.0	Ba
	20	10.6	Bu

121418
R Corvi

Mo.	Day	Est.	Obs.
7	3	6.9	Bb
	3	7.0	G
	12	7.2	G
	14	7.2	G

VARIABLE STAR OBSERVATIONS July, August and September 1914.—Continued.

122001
SS Virginis

Mo.	Day	Est.	Obs.
7	1	8.4	Bu
	3	8.3	Bb
	4	8.4	Bu
	11	8.6	Bu
	14	8.0	G
	20	9.0	Bu
	26	8.1	G

122532
T Can. Ven.

7	18	12.0	Ba

123160
T Urs. Maj.

6	27	9.9	Br
7	1	9.8	Bu
	2	10.0	Ly
	4	10.2	Bu
	5	10.2	Ly
	8	10.0	Bl
	10	10.5	Ly
	10	11.0	M
	11	10.8	E
	17	11.1	Ba
	17	10.9	Ly
	18	11.0	O
	18	11.1	Ly
	19	10.9	J
	21	11.2	B
	28	12.1	Ba
8	10	10.8	E
	15	12.4	Ba

123307
R Virginis

6	29	6.9	L
7	1	7.2	Bu
	3	7.1	Bb
	4	7.0	Bu
	7	7.4	Ly
	8	6.9	H
	8	7.3	L
	8	7.4	Bl
	10	7.5	Ly
	11	7.2	Bu
	13	7.6	Ly
	14	7.8	L
	14	7.6	G
	17	7.8	Ly
	17	8.3	Ba
	18	7.9	L
	19	8.3	Bl
	20	7.4	Bu
	20	8.1	Ly
	21	8.2	Ly
	25	8.8	L
	26	7.8	G
	30	8.5	Ly
8	7	9.3	Ly
	15	10.1	Ly
	18	10.3	Ly

123459
RS Urs. Maj.

Mo.	Day	Est.	Obs.
7	17	8.5	Ba
	28	8.8	Ba
8	14	9.5	Ba
	23	9.8	Ba
	31	10.7	Ba

123961
S Urs. Maj.

6	27	11.0	Br
7	1	10.6	L
	2	10.6	Ly
	5	10.5	Ly
	10	10.7	Ly
	10	10.8	M
	11	10.3	E
	16	11.6	L
	17	11.5	Ba
	17	10.9	Ly
	18	11.4	J
	21	11.0	B
	23	11.1	Ly
	23	11.3	L
	28	11.3	Bl
	28	11.2	M
	28	11.1	Ba
	28	10.9	Le
8	7	10.5	Ly
	10	10.1	L
	10	10.4	E
	14	10.3	Ba
	14	10.3	Bl
	15	10.2	Ly
	19	9.6	Ba
	21	9.2	M
	22	9.7	Pi
	23	9.7	Ly
	23	9.0	Ba
	23	8.7	Pi
	29	8.9	Bl
	29	8.8	M
	31	8.7	Ba

124204
RU Virginis

7	1	9.8	Bu
	3	9.5	Bb
	4	9.6	Bu
	11	10.4	L
	11	9.6	Bu
	18	10.4	L
	18	9.6	Ba
	20	9.2	Bu
	25	10.6	L

124606
U Virginis

7	1	9.4	Bu
	4	9.4	Ly
	4	9.2	Bu
	8	8.8	L
	11	9.0	Bu
	13	9.0	Ly

U Virginis

Mo.	Day	Est.	Obs.
7	14	8.5	L
	16	8.8	Ly
	18	8.0	Ba
	20	9.2	Bu
	20	8.6	Ly
	23	7.7	L
	31	8.2	L
8	2	8.3	Ly
	10	8.2	L

132202
V Virginis

7	3	11.7	Bb
	7	11.8	Bb

132422
R Hydrae

6	27	7.3	L
7	1	6.8	Bu
	4	6.8	Bu
	11	7.6	L
	11	7.0	Bu
	20	7.4	Bu

132706
S Virginis

7	3	11.4	Ly
	3	12.5	Bb
8	2	11.7	Ly

134440
R Can. Ven.

7	1	9.2	Bu
	3	9.0	Bb
	3	9.1	L
	3	9.3	Ly
	4	9.4	Bu
	10	9.6	Ly
	10	9.1	M
	11	9.6	E
	11	9.6	Bu
	13	9.8	Ly
	14	9.6	L
	17	10.0	Ly
	17	9.7	M
	18	9.8	O
	18	10.1	Ba
	20	9.8	Bu
	24	10.2	Ly
	24	10.2	E
	24	10.0	P
	26	10.0	O
	28	10.3	Ba
	31	10.4	G
	31	10.2	L
8	6	10.3	B
	9	10.6	Ly
	13	10.6	L
	14	10.6	Ba
	15	10.8	Ly

140113
Z Böotis

7	18	11.1	Ba
	28	11.8	Ba

141567
U Urs. Min.

7	17	11.2	Ba
	18	9.8	J
	26	10.9	M
	28	11.4	Ba
8	10	12.0	E
	14	12.0	Ba
	23	12.0	Ba
	31	12.8	Ba

141954
S Böotis

6	27	11.3	Br
7	2	11.0	Ly
	3	11.3	L
	10	11.1	Ly
	14	11.3	E
	16	11.8	L
	17	11.1	Ly
	17	11.8	Ba
	19	11.4	J
	20	11.5	B
	21	11.2	Ly
	21	11.8	L
	28	11.7	Ba
	29	11.5	M
8	10	11.6	E
	14	11.9	Ba
	18	11.0	Ly
	23	10.8	Ly
	23	11.9	Ba

142205
RS Virginis

7	1	8.2	Bu
	3	7.9	Bb
	4	8.0	Bu
	11	7.9	L
	11	8.0	Bu
	16	8.2	L
	17	8.1	Ba
	20	8.0	Bu
	22	8.2	L
	28	8.5	Ba
	31	8.4	L
8	10	8.6	L
	14	9.1	Ba

142539
V Böotis

6	27	8.3	Br
	29	8.4	L
7	1	8.2	Bu
	2	8.3	Ly
	3	8.4	L
	4	8.8	Bu

V Böotis

Mo.	Day	Est.	Obs.
7	5	7.8	G
	7	8.3	Ly
	9	7.9	Le
	9	8.3	Br
	10	7.9	G
	10	8.5	Ly
	11	8.8	Bu
	12	8.2	Bl
	13	8.0	G
	14	8.5	L
	17	7.6	Ba
	17	8.8	Ly
	17	9.0	St
	18	8.0	B
	18	8.3	O
	18	8.3	M
	18	8.2	Ma
	19	8.1	P
	19	8.5	L
	20	8.4	Bu
	20	8.3	E
	20	8.0	R
	21	8.2	G
	23	7.8	R
	25	8.4	G
	25	8.7	Ly
	26	8.5	O
	28	7.9	Le
	28	7.9	Ba
	28	8.4	L
	29	8.1	R
	30	8.9	Ly
	31	8.4	G
8	1	8.7	O
	6	8.0	Pi
	7	8.6	Bl
	7	8.6	B
	8	8.1	R
	9	8.2	R
	11	8.8	L
	11	8.9	Ly
	12	8.6	Ma
	13	8.2	R
	14	8.2	Ba
	14	8.9	Pi
	14	8.4	R
	15	8.3	R
	15	8.9	Pi
	16	8.4	R
	17	8.6	Bl
	18	9.0	Pi
	18	9.0	Ly
	18	8.3	R
	19	8.5	Ba
	20	8.7	R
	21	8.8	R
	21	9.1	Pi
	22	9.0	O
	22	8.8	Ma

VARIABLE STAR OBSERVATIONS July, August and September 1914.—Continued.

V Boötis

Mo.	Day	Est.	Obs.
8	23	9.1	Pi
	23	8.7	Ba
	26	8.6	M
	26	9.1	Pi
	27	9.0	O
	29	9.4	Bl
9	8	9.2	O

142584

R Camelop.

7	14	13.3	E

143227

R Boötis

7	3	10.8	L
	8	10.4	L
	9	11.0	Ly
	10	10.9	Ly
	11	10.0	M
	11	10.4	Bu
	12	10.6	Bl
	14	10.1	L
	17	9.9	Ba
	17	9.3	M
	18	9.5	B
	19	9.6	P
	20	9.9	Ly
	20	9.5	O
	20	9.7	E
	20	10.0	Bu
	24	9.4	B
	25	9.2	Ly
	26	9.2	O
	28	8.9	Ba
	28	8.8	L
	29	8.8	Ly
	30	8.6	Ly
	31	8.5	Ly
8	4	8.3	Ly
	7	8.2	B
	8	8.5	R
	8	8.0	Ly
	9	8.2	R
	11	8.3	L
	13	8.2	R
	13	7.8	Ly
	14	8.1	R
	14	7.9	Ba
	15	7.8	Ly
	15	8.0	R
	16	8.2	R
	17	7.9	Bg
	18	7.9	Bl
	18	8.1	R
	20	8.2	R
	21	8.2	R
	21	7.7	Ly
	22	8.0	O
	22	7.8	Ma
	23	7.5	Ba
	26	8.0	M

R Boötis

Mo.	Day	Est.	Obs.
8	27	7.8	O
	28	7.9	Ly
	29	7.5	Bl
9	8	7.9	O

144918

U Boötis

7	9	10.4	V
	17	10.8	Ba
	18	10.6	B
	19	10.5	Hu
	19	10.4	M
	21	10.7	V
	28	10.6	Ba
8	6	10.3	B
	9	10.4	V
	13	10.6	B
	20	10.4	V
	22	10.8	B

150018

RT Librae

7	11	11.2	L
	16	10.8	L
	23	9.5	L
8	9	9.1	L

150605

Y Librae

6	30	9.7	L
7	10	9.1	L
	15	9.0	L
	22	8.9	L
8	3	8.9	L

151520

S Librae

7	1	8.6	Bu
	3	8.7	Ly
	4	8.6	Bu
	10	8.6	Ly
	11	8.7	L
	11	8.2	Bu
	13	8.5	G
	17	9.0	L
	18	9.4	Ba
	20	8.0	Bu
	20	9.3	Ly
	21	9.4	Ly
	23	9.3	L
	31	9.5	Ly
8	4	9.7	Ly

151614

S Serpentis

7	11	9.7	V
	13	9.4	L
	18	9.2	E
	18	9.1	L
	19	8.8	M
	21	9.1	V

S Serpentis

Mo.	Day	Est.	Obs.
7	28	8.9	L
8	9	8.6	V
	12	8.3	L
	21	8.6	V

151731

S Cor. Bor.

6	28	10.6	Br
7	1	10.2	Bu
	3	10.6	Ly
	4	10.6	Bu
	10	10.6	Ly
	18	11.0	Ba
	18	11.1	E
	19	10.5	M
	20	10.5	Ly
	27	10.7	Ly
	28	11.5	Ba
8	4	10.8	Ly
	6	10.8	Br
	9	10.9	Ly
	14	12.0	Ba
	14	10.8	Br
	17	11.0	Ly
	21	11.0	Ly

151822

RS Librae

6	30	7.8	L
7	2	8.0	Bu
	8	7.8	Bu
	14	7.5	L
	14	7.6	Bu
	16	7.5	L
	18	6.9	Ba
	23	7.8	L
	24	7.6	Bu
8	9	8.1	L

152714

RU Librae

6	28	10.1	R
	30	10.8	L
7	2	10.6	Bu
	3	10.6	Bb
	7	10.4	Bb
	8	10.0	R
	8	10.4	Bu
	9	9.3	R
	11	9.5	L
	11	10.1	R
	12	8.9	G
	12	9.9	R
	13	9.4	R
	14	10.4	Bu
	15	8.4	L
	18	8.8	Ba
	20	9.0	R
	22	8.3	L
	23	8.3	R
	24	10.0	Bu

RU Librae

Mo.	Day	Est.	Obs.
7	29	8.3	R
8	4	8.2	L
	8	8.5	R
	9	8.3	L
	9	8.5	R
	13	8.5	R
	14	8.4	R
	15	8.5	R
	16	8.5	R
	18	8.7	R
	20	8.7	R
	21	8.6	R

153378

S Urs. Min.

6	29	9.6	L
7	2	9.6	Bu
	2	9.3	Ly
	5	8.9	Ly
	6	8.9	Ly
	8	9.0	Ly
	8	9.4	Bu
	11	9.6	Bl
	13	9.3	L
	14	9.0	Bu
	17	8.8	Ly
	18	9.0	Ba
	19	9.2	L
	20	9.5	E
	23	8.7	Ly
	24	8.7	Ly
	24	9.8	Bu
	26	9.8	M
	28	8.8	Bl
	28	8.9	Ba
	28	8.9	L
8	9	8.6	Ly
	11	8.7	L
	14	9.3	Bl
	15	8.9	Ba
	15	9.6	Pi
	17	8.6	Ly
	17	8.7	Bl
	21	9.1	Pi
	26	9.2	E
	26	8.5	Ly
	29	8.9	Bl

154428

R Cor. Bor.

6	27	5.9	Br
7	2	6.0	Bu
	2	6.1	Ly
	3	5.9	L
	4	6.0	Ma
	5	6.0	Ly
	7	6.0	Ly
	8	6.0	Ly
	8	6.0	Bl
	8	5.8	H
	9	5.9	Ly
	10	5.9	Ly

R Cor. Bor.

Mo.	Day	Est.	Obs.
7	11	5.9	L
	11	6.0	Bl
	11	6.0	Ly
	12	6.0	Mu
	12	6.0	L
	12	6.0	C
	12	6.0	Ma
	13	6.0	Mu
	13	6.0	G
	13	5.8	H
	14	5.9	Ly
	15	5.6	H
	15	6.0	L
	16	6.0	Ly
	16	6.1	Ma
	17	5.6	Ba
	17	6.0	Ly
	17	5.9	J
	18	5.9	Ly
	18	5.6	Ba
	18	5.9	J
	18	6.0	Bl
	18	5.6	H
	18	5.9	O
	19	5.6	Ba
	19	6.2	M
	19	5.9	O
	19	5.9	Hu
	19	6.0	J
	20	5.6	H
	20	6.0	Ly
	20	5.9	O
	20	6.0	J
	20	6.0	Wn
	20	6.1	L
	21	6.0	Ma
	21	6.0	Ly
	21	6.0	O
	21	6.0	Wn
	21	5.6	H
	21	5.8	P
	22	6.0	Bl
	23	5.9	Ly
	24	6.0	P
	24	6.0	O
	25	5.9	G
	25	5.7	J
	25	5.6	H
	26	6.3	Ma
	26	6.0	G
	26	6.0	O
	26	5.5	H
	28	5.6	Ba
	28	6.0	Ly
	28	5.8	Le
	29	5.8	J
	29	5.6	Pi
	29	6.0	Ly
	29	5.6	Ba
	31	5.8	C

VARIABLE STAR OBSERVATIONS July, August and September 1914.—Continued.

154536
R Cor. Bor.

Mo.	Day	Est.	Obs.
7	31	6.0	Bl
	31	6.0	L
8	1	6.0	O
	1	6.1	Ma
	2	6.0	L
	4	6.0	Bl
	6	5.9	Ly
	7	6.0	Bl
	7	6.4	Bg
	8	6.0	Br
	8	6.0	Bl
	10	6.0	L
	10	6.0	H
	10	6.0	Ly
	12	6.1	Ma
	12	6.0	Ly
	13	6.0	Bl
	14	5.6	Ba
	14	6.0	Bl
	14	6.1	C
	14	5.6	Pi
	14	6.1	Br
	15	5.6	Ba
	15	5.8	J
	15	6.0	Ma
	15	6.0	Bl
	16	5.6	H
	16	6.0	Bl
	16	5.9	Ba
	16	6.0	Ly
	17	5.9	Ly
	17	5.9	Ba
	17	6.0	Bl
	18	6.0	Ma
	18	6.0	Bl
	18	5.7	Ba
	18	5.5	H
	19	6.0	Bl
	19	5.6	H
	19	6.0	Ly
	19	5.5	J
	21	5.5	Bg
	21	6.0	Ma
	22	6.0	Ly
	22	6.0	Pi
	22	6.0	O
	22	5.9	Hu
	22	5.6	H
	23	5.4	J
	23	6.0	Pi
	23	6.0	Ba
	24	5.9	Ly
	27	6.0	O
	29	5.8	J
	29	6.0	Bl
	30	6.0	Bl
	31	5.8	Ba
9	7	6.0	O
	8	6.0	O

X Cor. Bor.

Mo.	Day	Est.	Obs.
7	17	9.0	Ba
	19	9.4	J
	28	9.4	Ba
8	14	9.8	Ba
	23	10.5	Ba

154539
V Cor. Bor.

Mo.	Day	Est.	Obs.
7	2	10.2	Bu
	8	10.6	Bu
	17	10.5	Ba
	20	10.5	Ly
	20	10.7	E
	28	10.6	Ly
	28	10.3	Ba
8	4	10.7	Ly
	11	10.7	Ly
	14	10.4	Ba
	18	10.8	Ly
	26	10.8	E

154615
R Serpentis

Mo.	Day	Est.	Obs.
6	24	7.9	R
	27	8.3	R
	28	8.1	R
7	2	8.2	Bu
	3	8.2	Ly
	8	8.4	Bu
	8	8.8	Bl
	8	8.5	R
	9	8.5	R
	10	8.3	Ly
	11	8.8	R
	12	8.7	R
	13	9.0	R
	14	8.4	Bu
	18	9.0	E
	18	8.8	O
	18	8.8	Ba
	19	8.9	M
	20	8.8	O
	20	9.6	R
	20	8.4	Ly
	22	8.7	Bl
	23	9.6	R
	24	8.8	Bu
	24	9.2	O
	25	8.5	Ly
	25	8.9	G
	26	9.2	O
	28	9.0	Bl
	29	9.1	Ba
	29	9.6	R

R Serpentis

Mo.	Day	Est.	Obs.
8	4	8.8	Ly
	7	9.5	B
	8	10.0	R
	9	10.0	R
	11	9.5	B
	13	9.1	Ly
	13	10.1	R
	14	10.5	R
	15	10.0	Ba
	15	10.2	R
	16	10.5	R
	17	9.4	Ly
	18	10.7	R
	20	10.8	R
	21	10.9	R
	21	9.5	Ly
	22	10.5	O
	27	11.0	O

155823
RZ Scorpii

Mo.	Day	Est.	Obs.
7	3	9.9	G
	12	10.2	G
	21	10.8	G

155847
X Herculis

Mo.	Day	Est.	Obs.
7	8	6.8	H
	13	6.0	H
	15	5.8	H
	18	5.8	H
	21	6.0	H
	25	6.1	H
	26	6.0	H
	31	6.4	L
8	2	6.3	L
	10	6.8	H
	13	6.3	L
	15	5.7	R
	16	6.3	H
	16	5.7	R
	18	5.8	R
	18	6.3	H
	19	6.3	H
	20	6.3	R
	21	5.8	R
	22	6.2	H

160118
R Herculis

Mo.	Day	Est.	Obs.
7	9	9.6	V
	18	9.6	Ba
	19	9.4	Hu
	21	9.8	V
	29	10.7	Ba
8	9	10.5	V
	15	11.3	B
	15	11.3	Ba
	22	10.0	Hu

160210
U Serpentis

Mo.	Day	Est.	Obs.
8	20	12.3	E

160625
RU Herculis

Mo.	Day	Est.	Obs.
7	19	12.6	Hu
	19	13.2	Ba
8	24	13.6	B

161138
W Cor. Bor.

Mo.	Day	Est.	Obs.
7	14	10.8	Bu
	17	10.0	Ba
	18	10.0	E
	20	9.8	B
	24	10.6	Bu
	28	9.2	Ba
8	14	8.4	Ba
	15	8.3	B
	20	8.8	E
	22	8.9	Hu
	23	8.3	Ba
	24	7.9	B

162112
V Ophiuchi

Mo.	Day	Est.	Obs.
7	19	7.8	Ba
	20	8.3	Ly
	23	8.4	L
	24	8.2	Ly
	28	8.2	Bl
8	9	8.2	Ly
	10	8.1	L
	14	8.2	Bl
	16	8.1	Ly
	17	8.2	Bl

162119
U Herculis

Mo.	Day	Est.	Obs.
6	24	9.2	R
	27	9.3	R
	27	9.4	Br
	28	9.4	R
7	2	9.2	Ly
	2	9.6	Bu
	3	10.0	M
	7	9.3	Ly
	8	9.7	R
	8	9.6	Bu
	11	9.5	Bl
	11	9.6	R
	12	9.8	Ma
	12	9.7	R
	13	9.8	R
	14	10.0	Bu
	14	9.5	Ly
	18	9.7	Ly
	19	9.7	Ba
	20	9.6	B
	20	9.7	M
	20	9.8	R
	23	9.7	R

U Herculis

Mo.	Day	Est.	Obs.
7	24	10.2	Bu
	25	10.1	Ly
	28	10.0	Bl
	28	9.9	Ba
	29	9.7	R
	31	10.3	G
	8	10.3	R
	8	10.4	Br
	9	10.4	Ly
	9	10.5	R
	10	10.5	E
	13	10.7	R
	14	10.7	R
	15	10.5	Ba
	15	10.9	R
	16	10.7	R
	17	10.6	Ly
	17	10.2	Bl
	18	10.9	R
	20	10.7	R
	21	11.1	R
	21	10.7	Ly
	22	10.3	Hu
	25	11.0	R

162807
SS Herculis

Mo.	Day	Est.	Obs.
6	27	11.1	L
7	11	12.0	L
	16	12.3	L
	17	12.4	Ba
	20	12.2	B
	22	12.3	L
	28	12.3	L
	28	12.0	Ba
8	9	10.8	L
	10	10.5	L
	11	10.2	V
	12	10.4	L
	13	10.6	Bl
	14	10.3	Ba
	15	10.1	B
	17	10.2	Bl
	20	10.1	E
	21	9.1	V
	23	9.4	Ba

162815
S Ophiuchi

Mo.	Day	Est.	Obs.
7	19	12.2	Ba

163137
W Herculis

Mo.	Day	Est.	Obs.
7	17	11.0	Ba
	19	8.5	Hu
	20	9.2	M
	24	11.4	Bu
	28	10.6	Ba
8	8	10.3	Br
	14	10.0	Ba
	15	10.2	B

VARIABLE STAR OBSERVATIONS July, August and September 1914—Continued.

W Herculis

Mo.	Day	Est.	Obs.
8	22	9.5	Hu
	23	9.5	Ba
	24	9.4	B

163172
R Urs. Min.

Mo.	Day	Est.	Obs.
7	2	9.4	Bu
	8	9.4	Bu
	14	9.2	Bu
	15	9.3	E
	18	9.4	Ly
	19	9.1	Ba
	24	9.3	Ly
	24	9.2	Bu
	26	9.8	M
	28	9.4	Ly
	28	9.0	Ba
8	7	9.4	Ly
	14	9.4	Bl
	15	9.4	Ly
	15	9.5	Ba
	17	9.3	Bg
	20	9.5	E
	20	9.2	R
	21	9.2	R

163266
R Draconis

Mo.	Day	Est.	Obs.
7	11	9.8	M
	17	11.8	Ba
	20	11.8	Sp
	21	12.0	Sp
	26	11.6	M
	28	11.9	Ba
8	12	13.0	E
	15	12.3	Ba
	23	12.3	Ba

164055
S Draconis

Mo.	Day	Est.	Obs.
7	20	8.5	M
	25	8.3	G
8	29	8.6	M

164319
RR Ophiuchi

Mo.	Day	Est.	Obs.
7	19	9.3	Ba
8	13	9.5	B
	22	10.0	B

164715
S Herculis

Mo.	Day	Est.	Obs.
6	28	8.2	Br
7	2	8.4	Bu
	3	8.1	M
	7	8.0	Ly
	8	8.4	Bu
	14	8.0	Bu
	14	7.7	Ly
	17	7.5	Ba
	18	7.5	Ly

S Herculis

Mo.	Day	Est.	Obs.
	19	8.2	J
	19	7.6	O
	20	7.8	B
	20	7.4	M
	21	7.6	Ma
	21	7.5	Ly
	23	7.2	Ly
	24	7.6	Bu
	25	7.6	
	26	7.6	O
	28	7.4	Ba
	29	7.2	Ly
8	3	7.8	Bl
	7	7.1	Ly
	12	7.6	E
	12	7.8	Ma
	14	8.0	Br
	14	7.9	Bl
	14	7.6	Ba
	15	7.3	Ly
	17	7.8	Bl
	20	8.2	R
	21	7.7	R
	21	8 0	Ma
	22	7.6	Ly
	23	7.6	Ba
	26	8.3	E
	27	8.1	O
	29	8.4	M
	30	8.1	Bl
9	8	8.5	O

165030
RR Scorpii

Mo.	Day	Est.	Obs.
7	3	6.5	G
	10	6.6	G
	12	6.6	G
	17	6.8	G
	21	7.3	G
	29	8.3	R
	31	7.6	G
8	8	9.6	R
	9	9.1	R
	13	9.4	R
	14	9.5	R
	15	9.5	R
	16	9.6	R
	18	9.1	R
	20	9.7	R
	21	9.7	R

165631
RV Herculis

Mo.	Day	Est.	Obs.
6	29	10.9	L
7	3	10.5	Bu
	3	10.5	M
	10	10.5	Bu
	14	11.2	E
	14	10.5	L
	16	10.4	Bl
	17	10.0	Bu

RV Herculis

Mo.	Day	Est.	Obs.
7	17	11.0	Ba
	19	10.9	L
	19	10.1	Hu
	20	10.8	M
	24	11.2	L
	28	11.6	M
	28	11.9	Ba
8	6	12.1	E
	12	12.4	L
	15	12.8	B
	15	12.6	Ba

170215
R Ophiuchi

Mo.	Day	Est.	Obs.
6	28	10.4	Br
7	3	9.6	Bu
	10	9.4	Bu
	10	9.0	M
	17	9.4	Bu
	17	8.7	Ba
	19	8.4	J
	20	8.1	M
	20	8.5	Bl
	21	8.2	Ma
	23	8.0	L
	25	8.0	B
	25	8.4	Ly
	28	8.2	Ly
	28	7.9	Ba
	29	8.0	Bl
8	3	7.6	L
	4	8.0	Ly
	6	7.5	Bl
	8	7.8	Br
	8	7.9	Ly
	12	8.0	Ma
	13	7.7	L
	13	7.8	Ly
	14	7.9	Ba
	14	7.8	Br
	14	7.5	Bl
	16	7.7	Ly
	17	7.7	Bl
	21	7.9	Ma
	21	7.5	Ly
	23	7.8	Ba
	28	7.6	Ly
	30	7.6	Bl

170627
RT Herculis

Mo.	Day	Est.	Obs.
8	15	11.9	B
	15	11.8	Ba
	23	11.3	Ba

171333
u Herculis

Mo.	Day	Est.	Obs.
6	24	4.5	R
7	11	4.5	R
	12	4.8	R
	13	4.6	R
	20	4.3	R

u Herculis

Mo.	Day	Est.	Obs.
7	23	4.4	R
8	1	4.4	R
	8	4.1	R
	9	4.2	R
	13	4.7	R
	14	4.6	R
	15	5.2	R
	16	4.7	R
	17	4.6	R
	18	4.7	R
	20	5.1	R
	21	4.6	R
	25	4.7	R

171401
Z Ophiuchi

Mo.	Day	Est.	Obs.
7	10	9.4	Bu
	11	8.4	V
	17	9.6	Bu
	18	9.0	O
	19	8.9	Ba
	21	9.0	V
	29	8.9	Ba
8	11	9.0	V
	18	9.0	Bl
	20	9.3	E
	21	9.0	V
	23	9.6	Pi

171723
RS Herculis

Mo.	Day	Est.	Obs.
6	29	9.7	L
7	3	9.2	M
	11	9.0	L
	11	9.0	V
	15	9.1	L
	17	9.4	Ba
	20	8.9	L
	20	8.9	Hu
	21	8.6	V
	28	8.7	Ba
	31	8.8	L
8	11	7.9	V
	12	8.5	L
	14	8.0	Ba
	15	8.0	B
	21	8.0	V
	22	8.1	Hu

172808
RU Ophiuchi

Mo.	Day	Est.	Obs.
7	19	13.0	Ba
	25	12.9	B
	28	12.8	Ba
8	10	11.9	E
	13	11.8	M
	15	11.8	Ba
	23	11.7	Ba

175458
T Draconis

Mo.	Day	Est.	Obs.
7	3	9.4	Bu
	10	9.0	Bu
	11	9.1	M
	11	10.2	V
	14	9.6	E
	17	9.0	Bu
	20	9.6	Sp
	21	10.0	V
	28	9.7	Ba
8	11	10.0	V
	13	9.2	M
	14	9.6	R
	15	10.0	Ba
	15	9.4	R
	16	9.5	R
	17	10.0	Bl
	28	9.6	R
	30	9.4	R
	30	10.1	E
	31	9.5	R
	31	10.5	V

175519
RY Herculis

Mo.	Day	Est.	Obs.
8	15	13.4	Ba
	20	13.4	E
	23	12.9	Ba
	24	13.0	B

175829
W Sagittarii

Mo.	Day	Est.	Obs.
8	25	5.1	R

180565
W Draconis

Mo.	Day	Est.	Obs.
7	19	9.5	Ba
	20	9.3	Sp
	28	9.7	Ba
8	14	10.0	Ba
	23	10.2	Ba

180531
T Herculis

Mo.	Day	Est.	Obs.
7	5	10.1	Ly
	7	10.2	Ly
	18	9.9	Bl
	19	13.3	Ba
	28	12.4	L
8	6	12.3	M
	10	11.7	L
	12	11.2	E
	15	11.4	M
	18	11.0	L
	22	11.0	Hu
	29	9.4	M

VARIABLE STAR OBSERVATIONS July, August and September 1914.—Continued.

181103
RY Ophiuchi

Mo.	Day	Est.	Obs.
7	19	11.9	Ba
	25	10.6	B
	26	10.2	V
8	11	9.1	V
	21	9.0	V

181136
W Lyrae

Mo.	Day	Est.	Obs.
6	24	8.2	R
	27	8.2	R
	27	8.3	Br
	28	8.1	R
7	3	8.0	Bu
	3	7.9	G
	8	8.1	R
	9	8.1	Br
	10	7.7	G
	10	8.1	M
	10	7.6	Bu
	11	8.0	R
	12	8.0	R
	13	8.0	R
	14	8.0	E
	17	7.6	Bu
	17	7.6	Ba
	18	8.2	Bl
	19	8.3	P
	19	7.8	O
	19	7.7	M
	20	8.2	R
	20	8.0	Hu
	23	7.8	R
	25	7.6	G
	26	7.6	O
	28	8.0	Ba
	29	8.4	Bl
	31	7.6	G
8	1	7.9	R
	8	8.5	R
	9	8.5	R
	12	8.5	M
	13	8.6	R
	14	8.6	Ba
	14	8.9	Bl
	14	8.5	R
	15	8.4	R
	15	8.5	Ma
	16	8.4	R
	16	8.6	M
	17	9.1	Bl
	18	8.5	R
	20	8.4	R
	21	8.7	R
	22	9.1	Ma
	22	9.0	Le
	22	8.9	Hu
	23	9.3	Ba
	23	8.9	Sp
	23	8.7	M
	24	8.8	Sp
	26	9.0	Sp

182224
SV Herculis

Mo.	Day	Est.	Obs.
8	24	11.7	B

182306
T Serpentis

Mo.	Day	Est.	Obs.
7	19	10.3	Ba
	20	10.3	M

183225
RZ Herculis

Mo.	Day	Est.	Obs.
7	19	12.3	Ba

183308
X Ophiuchi

Mo.	Day	Est.	Obs.
7	3	8.8	Bu
	3	8.5	Ly
	10	8.6	Bu
	13	8.3	Ly
	14	8.4	V
	14	8.5	L
	17	8.6	Bu
	17	8.2	Ba
	17	8.0	Bl
	18	8.4	Ly
	19	8.5	O
	20	8.6	E
	20	8.2	M
	20	8.4	L
	21	8.2	Ma
	23	9.4	R
	25	8.1	Ly
	26	8.5	O
	26	8.0	V
	26	8.2	Ma
	28	8.1	Ba
	29	8.2	Ly
8	4	8.0	Ly
	8	8.0	Bl
	12	7.8	V
	12	8.1	L
	12	8.0	Ma
	12	8.1	V
	13	7.9	Ly
	13	8.1	M
	14	8.0	Bl
	15	8.0	Ma
	15	7.8	Ba
	17	7.8	Bl
	21	7.8	Ly
	21	7.8	V
	21	7.8	Ma
	23	7.5	Ba
	28	8.0	Ly
	29	7.6	Bl

184243
RW Lyrae

Mo.	Day	Est.	Obs.
7	15	13.3	E
8	12	12.8	E
	15	13.5	Ba

184205
R Scuti

Mo.	Day	Est.	Obs.
6	29	5.2	L
7	1	5.3	L
	3	5.3	L
	3	5.7	Ly
	4	5.9	M
	4	5.4	Ma
	10	6.0	Bu
	10	5.8	Ly
	11	6.5	R
	11	5.3	L
	12	5.8	G
	13	6.3	R
	13	6.1	H
	14	5.7	Ly
	15	5.9	H
	15	5.3	L
	16	5.7	Ma
	17	5.7	Ba
	17	6.5	St
	18	6.1	H
	18	5.8	O
	18	5.7	Ly
	19	5.8	O
	19	5.4	L
	19	5.6	Ba
	20	5.8	Ly
	20	5.8	O
	20	5.8	H
	20	5.5	Hu
	20	6.6	R
	21	5.6	Ma
	21	5.8	O
	21	5.9	H
	22	5.6	Bl
	23	5.8	Ly
	24	5.3	L
	24	5.2	P
	24	5.8	O
	25	5.8	H
	25	5.3	G
	26	5.7	Ma
	26	5.8	O
	26	5.9	H
	28	5.2	M
	28	5.5	Ba
	28	5.6	Ly
	29	5.5	Ba
	29	6.3	R
	31	5.6	G
	31	5.7	Ly
8	1	7.6	R
	2	5.5	L
	6	5.7	Ly
	8	5.2	Br
	8	5.9	R
	9	5.1	R
	9	5.2	L
	10	5.6	Ly
	10	5.8	H
	12	5.6	Ly

R Scuti

Mo.	Day	Est.	Obs.
	12	5.7	Ma
	13	5.4	R
	13	5.7	Bl
	14	5.5	R
	14	5.3	Br
	14	5.6	Ba
	14	5.6	Ma
	15	5.7	Ba
	15	5.6	Ma
	15	5.8	Ly
	15	5.4	R
	15	5.7	Bl
	16	5.7	R
	16	5.6	Ba
	16	6.4	H
	17	5.6	Ba
	17	5.6	Bl
	18	5.7	Ma
	18	5.7	Ly
	18	6.5	H
	18	5.7	Ba
	18	5.7	R
	19	6.5	H
	19	5.8	Ba
	19	5.6	Bl
	20	5.3	R
	21	5.4	R
	21	5.8	Ma
	22	6.0	H
	22	5.8	O
	22	5.5	Pi
	23	5.9	Hu
	23	5.9	Ba
	23	5.5	Pi
	24	5.5	Pi
	25	5.8	P
	25	5.5	Pi
	26	5.5	Pi
	27	5.8	O
	30	5.6	Bl
	31	5.7	Ba
9	7	6.0	O
	8	6.1	O

190108
R Aquilae

Mo.	Day	Est.	Obs.
7	14	11.3	L
	16	11.4	B
	19	10.5	Ba
	20	11.4	L
	20	11.5	M
	20	11.1	Sp
	20	11.1	E
	25	10.9	B
	29	10.3	Ba
	31	10.9	L
8	6	9.8	B
	12	10.7	L
	13	9.8	B

R Aquilae

Mo.	Day	Est.	Obs.
8	13	9.7	M
	15	9.8	Ba
	16	10.3	Bl
	21	10.3	E
	29	9.4	Bl

190926
X Lyrae

Mo.	Day	Est.	Obs.
7	8	9.3	Ly
	13	9.3	Ly
	18	9.2	Ly
	19	9.4	P
	19	9.2	Ba
	20	9.2	M
	21	9.0	Ma
	22	9.2	Bl
	25	9.3	Ly
	29	8.9	Ba
8	7	9.1	Ly
	8	8.7	Bl
	13	9.3	M
	13	9.3	Bl
	14	9.2	Ma
	14	9.2	E
	15	8.9	Ly
	15	9.2	Pi
	17	9.0	Bl
	21	9.0	Ly
	22	9.2	Ma
	23	9.0	M
	30	9.0	Bl

191019
R Sagittarii

Mo.	Day	Est.	Obs.
7	3	8.5	L
	3	8.4	Bu
	10	8.6	Bu
	14	9.2	L
	17	8.8	Bu
	17	9.3	L
	19	10.3	Ba
	28	10.6	L
	29	10.6	Bl
8	11	10.9	L

191033
RY Sagittarii

Mo.	Day	Est.	Obs.
7	19	7.4	Ba
	21	7.6	G
	25	7.4	G
	26	7.4	G

191350
TZ Cygni

Mo.	Day	Est.	Obs.
7	13	11.1	L
	20	11.1	L
	31	10.8	L
8	18	10.6	L

VARIABLE STAR OBSERVATIONS July, August and September 1914—Continued.

191637
U Lyrae

Mo.	Day	Est.	Obs.
7	15	11.7	E
	19	10.7	Ba
	28	12.0	Ba
8	21	11.7	E

192928
TY Cygni

Mo.	Day	Est.	Obs.
7	17	11.1	Ba

193311
RT Aquilae

Mo.	Day	Est.	Obs.
7	1	9.5	L
	3	9.6	Bu
	10	9.6	Bu
	14	8.5	L
	17	9.4	Bu
	17	8.3	Ba
	18	8.8	O
	19	8.2	L
	19	8.7	O
	20	8.7	O
	24	8.4	O
	24	8.2	L
	26	8.4	O
	28	8.1	Ba
8	1	8.4	O
	2	8.2	L
	13	8.6	L
	14	8.0	Ba
	22	8.7	O
	23	8.2	Ba
	27	8.7	O
9	8	9.3	O

193449
R Cygni

Mo.	Day	Est.	Obs.
6	27	9.5	L
	27	10.0	R
	28	9.9	R
7	2	9.5	M
	3	9.4	Bu
	5	9.6	M
	8	10.3	R
	9	10.3	R
	10	9.8	M
	10	9.8	Bu
	11	10.2	R
	12	10.3	R
	12	9.8	Bl
	13	10.3	R
	13	9.8	L
	17	9.8	Bu
	17	9.0	St
	17	9.8	G
	18	9.6	O
	19	9.3	Ba
	19	9.9	M
	20	10.3	R
	20	10.0	E
	20	10.0	Hu

R Cygni

Mo.	Day	Est.	Obs.
7	21	9.5	B
	23	10.6	R
	24	10.3	L
	25	10.3	Ly
	28	10.0	Ba
	29	10.7	R
	30	10.4	M
	31	10.9	Ly
8	1	10.6	R
	7	10.5	Ly
	8	10.9	R
	9	11.0	R
	12	10.7	L
	14	11.4	Ba
	14	11.0	M
	14	11.3	R
	15	11.6	R
	15	10.6	Ly
	16	11.5	R
	18	11.4	R
	18	10.6	Ly
	20	11.7	R
	21	12.0	R
	22	11.2	M
	22	10.7	Le
	23	10.6	Hu
	25	11.8	R

193509
RV Aquilae

Mo.	Day	Est.	Obs.
7	3	9.0	Bu
	10	9.2	Bu
	17	9.2	Bu
	18	9.6	O
	19	9.6	Ba
	24	9.4	O
	26	9.7	O
8	13	11.7	E
	22	11.0	O

193742
TT Cygni

Mo.	Day	Est.	Obs.
6	27	8.3	R
	28	8.3	R
7	2	8.3	Ly
	3	8.0	Bu
	3	8.4	Ly
	6	8.5	Ly
	8	8.6	R
	10	8.2	Bu
	11	8.4	R
	12	8.3	R
	12	8.4	Ly
	13	8.1	L
	13	8.3	R
	16	8.5	Bl
	17	8.2	Bu
	18	8.1	Ly
	19	7.9	L
	20	8.2	E

TT Cygni

Mo.	Day	Est.	Obs.
7	20	8.2	R
	20	7.6	Hu
	20	8.5	Bl
	21	8.0	Ma
	23	8.2	R
	24	7.8	Ly
	28	8.2	Bl
	29	7.0	Ba
	29	8.3	R
	31	8.0	Ly
8	8	8.3	R
	9	8.2	R
	11	8.0	Ly
	12	7.2	L
	13	8.2	R
	14	8.2	R
	14	7.8	M
	14	8.1	Bl
	14	7.9	Ma
	15	8.2	R
	16	7.8	R
	17	8.1	Bl
	18	7.8	R
	18	8.0	L
	20	8.4	R
	21	8.2	M
	21	7.7	E
	21	7.9	Bl
	21	7.8	R
	22	7.3	Ma
	23	7.1	Hu
	26	7.9	R
	27	8.2	Bl

194048
RT Cygni

Mo.	Day	Est.	Obs.
7	2	11.6	M
	5	12.0	M
	17	12.0	Ba
	19	11.8	M
	20	11.6	Hu
	21	11.5	B
	29	12.0	Ba
	31	10.8	Ly
8	4	10.6	Ly
	7	10.2	Ly
	14	10.0	Ba
	15	9.6	Ly
	18	9.4	Ly
	18	10.2	L
	22	9.4	M
	22	9.2	Bl
	22	9.2	Le
	23	9.3	Hu
	23	9.1	Ba
	30	8.8	Bl

194348
TU Cygni

Mo.	Day	Est.	Obs.
7	5	12.5	M
	9	11.0	Ly
	12	10.5	L
	14	10.7	Ba
	14	10.8	M
8	15	10.6	Ly
	16	10.2	Bl
	17	10.3	M
	18	10.5	L
	22	10.0	Bl
	22	10.5	M
	23	9.8	Ba
	30	10.0	Bl

194632
χ Cygni

Mo.	Day	Est.	Obs.
7	13	10.9	B
	20	10.8	Hu
	28	12.4	L
8	10	11.2	L
	14	10.5	Bl
	15	10.2	M
	17	10.3	Bl
	18	10.4	L
	19	10.1	M
	19	10.3	Bl
	21	10.0	M
	23	10.1	Hu
	23	11.0	J
	27	9.5	Bl
	27	9.9	O
	27	10.2	E
	30	9.7	Bl
	30	9.2	M
9	8	8.6	O

194604
X Aquilae

Mo.	Day	Est.	Obs.
7	3	8.4	L
	3	8.4	Bu
	10	8.2	Bu
	12	8.8	R
	13	8.7	G
	13	8.7	R
	14	8.8	L
	15	8.8	V
	17	8.2	Bu
	18	8.8	O
	19	8.8	L
	20	8.9	R
	23	8.9	R
	24	8.9	L
	26	8.5	M
	26	8.8	V
	29	9.0	Ba
	29	9.0	R
8	6	9.4	B
	8	9.2	R
	9	9.3	R
	11	9.4	V
	12	10.1	L

X Aquilae

Mo.	Day	Est.	Obs.
8	13	9.8	R
	13	9.8	B
	14	10.0	M
	14	9.9	R
	15	10.3	Ba
	15	10.0	R
	16	10.4	Bl
	16	10.1	R
	18	9.9	R
	20	10.1	R
	21	10.9	Bl
	21	10.4	E
	21	10.1	V
	21	11.0	M
	21	10.2	R
	22	10.6	B
	26	10.4	R
	27	11.1	O

195116
S Sagittae

Mo.	Day	Est.	Obs.
7	18	5.5	O
	19	5.5	O
	20	5.6	O
	21	5.6	O
	24	6.0	O
	26	6.4	O
	31	5.6	Mu
8	1	6.3	O
	1	5.7	Mu
	2	5.6	Mu
	6	5.7	Mu
	7	5.9	Mu
	8	6.0	R
	8	6.2	Mu
	9	5.5	R
	13	5.5	R
	14	5.6	Mu
	14	5.8	R
	15	5.8	Mu
	15	5.4	R
	16	5.9	Mu
	16	5.7	R
	17	6.1	Mu
	18	5.9	R
	20	5.6	R
	21	5.6	Mu
	21	5.3	R
	22	5.4	O
	25	6.1	Mu
	26	6.2	R
	27	6.2	O
9	7	5.3	O
	8	5.4	O

195838
Z Cygni

Mo.	Day	Est.	Obs.
7	2	9.6	M
	3	9.5	Ly
	6	9.3	Ly
	9	9.6	Br

VARIABLE STAR OBSERVATIONS July, August and September 1914—Continued.

Z Cygni

Mo.	Day	Est.	Obs.
7	9	9.4	Ly
	10	9.8	M
	12	9.4	Ly
	15	9.5	V
	18	9.3	Ly
	19	9.7	M
	23	9.4	Ly
	26	9.2	V
	29	8.6	Ba
	30	9.4	M
	31	9.2	Ly
8	4	9.2	Ly
	8	9.2	Br
	12	9.2	V
	14	9.5	Br
	14	9.2	M
	16	9.5	Ly
	17	9.2	M
	21	9.1	V
	21	9.3	Ly
	24	9.5	Sp
	26	9.3	Sp

200212
SY Aquilae

7	3	11.4	L
	16	11.9	B
	25	12.1	B
	29	12.0	Ba
8	13	12.1	B
	15	12.0	B
	22	12.0	B

200647
SV Cygni

6	27	9.4	L
	28	9.3	R
7	2	9.2	M
	2	9.1	Ly
	3	9.2	Bu
	7	9.0	Ly
	8	9.3	R
	10	9.2	Bu
	11	9.3	R
	12	9.2	Ly
	12	9.2	R
	13	9.3	R
	14	9.4	L
	17	9.4	Bu
	17	9.4	Bl
	18	9.1	Ly
	19	8.1	M
	19	9.3	P
	20	9.3	R
	21	8.9	B
	21	8.9	Ma
	21	9.0	E
	22	9.5	L
	23	9.2	R
	25	8.4	G

SV Cygni

Mo.	Day	Est.	Obs.
7	25	8.9	Ly
	26	9.0	Ma
	28	9.2	Bl
	29	9.3	R
	29	8.2	Ba
	30	9.0	Ly
8	1	9.1	R
	8	9.0	R
	8	9.4	Bl
	9	9.2	R
	9	9.5	Pi
	11	8.9	Ly
	12	9.4	L
	13	9.3	R
	14	9.0	Bl
	14	9.2	R
	15	9.2	Ma
	15	9.5	R
	16	9.4	R
	17	9.5	Bl
	17	9.2	E
	18	9.4	R
	18	9.4	M
	18	8.8	Ly
	20	9.3	R
	21	9.3	R
	22	9.5	Ma
	22	8.3	Le
	23	7.7	Hu
	26	9.3	R
	27	9.3	Bl

200715a
S Aquilae

7	3	10.5	M
	16	11.7	B
	19	11.7	P
	20	11.0	Sp
8	16	10.4	M
	29	10.1	M

200715b
RW Aquilae

7	3	9.4	Bu
	3	9.6	M
	10	9.2	Bu
	16	9.1	B
	17	9.2	Bu
	19	9.5	P
	20	9.5	Sp
8	16	9.6	M
	29	9.0	M

200812
RU Aquilae

7	25	13.2	B

200916
R Sagittae

Mo.	Day	Est.	Obs.
7	11	9.1	R
	12	9.2	R
	13	9.0	R
	16	9.0	B
	20	9.0	Sp
	20	9.1	R
	23	9.1	R
	29	9.1	R
8	8	9.1	R
	9	9.3	R
	13	10.1	R
	14	9.9	R
	15	9.8	R
	16	10.0	R
	18	9.7	R
	20	9.2	R
	21	9.2	R
	26	8.9	R

200906
Z Aquilae

7	20	9.5	B
	25	10.2	B
8	13	11.5	B

200938
RS Cygni

7	3	8.8	Bu
	3	8.7	Ly
	6	8.5	Ly
	10	8.7	Bu
	13	8.8	L
	17	8.8	Bu
	18	8.8	Ly
	19	8.7	L
	21	8.6	Ly
	25	7.6	G
	29	8.9	J
	30	8.7	Ly
	31	8.8	L
8	11	8.8	Ly
	13	8.9	R
	14	8.9	R
	15	8.8	R
	16	9.1	R
	18	8.9	R
	18	8.7	Ly
	18	8.8	L
	20	8.6	R
	21	8.7	R
	22	7.7	Le
	22	8.1	Ma
	26	8.7	R

201008
R Delphini

7	19	11.5	J
	26	11.0	O
8	13	9.3	Bl
	14	9.1	Ba
	19	8.6	Bl
	22	8.8	O

R Delphini

Mo.	Day	Est.	Obs.
8	27	8.7	O
	29	8.5	M
9	8	8.4	O

201139
RT Sagittarii

7	29	7.2	Bl

201521
RT Capricorni

7	5	8.0	L
	14	7.8	L
	20	7.9	L
	31	7.9	L
8	12	7.1	L
	23	8.3	Ly
	28	7.8	Ly

201647
U Cygni

6	24	8.8	R
	27	7.4	R
	28	7.7	R
7	2	8.1	M
	3	7.9	Ly
	3	7.2	Bu
	6	7.7	Ly
	8	7.4	R
	10	7.3	R
	10	7.0	Bu
	11	7.7	R
	12	7.7	Ly
	12	7.5	R
	13	8.0	L
	13	7.8	R
	17	6.8	Bu
	17	7.8	Bl
	18	7.6	Ly
	18	7.5	O
	19	8.7	J
	19	7.6	M
	20	7.3	R
	21	7.7	E
	22	8.0	L
	23	7.3	R
	25	7.3	G
	25	7.6	Ly
	29	7.5	R
	30	7.6	Ly
8	1	8.0	R
	8	7.2	R
	8	7.6	Bl
	9	7.0	R
	12	7.5	L
	13	7.4	R
	14	7.6	Ly
	14	7.6	Bl
	14	7.1	R
	15	7.1	R
	16	7.7	R
	17	7.8	E

U Cygni

Mo.	Day	Est.	Obs.
8	17	7.6	Bl
	18	7.8	R
	18	7.0	M
	20	7.0	R
	21	6.9	R
	23	7.5	Ly
	27	7.3	Bl

202539
RW Cygni

6	28	9.1	Br
7	2	9.0	M
	2	8.9	Ly
	3	9.0	Ly
	3	8.6	G
	3	9.0	Bu
	5	9.0	Bl
	6	8.8	Ly
	10	8.4	G
	10	8.9	M
	10	9.0	Bu
	11	9.0	Bl
	12	9.0	Ly
	17	9.0	Bu
	17	8.4	G
	18	8.9	Ly
	18	9.2	Bl
	19	9.0	M
	20	8.5	O
	21	9.0	Ma
	21	8.9	E
	22	8.8	Bl
	24	9.0	Ly
	25	8.2	G
	26	9.0	M
	26	9.0	Ma
	28	9.0	Bl
	28	9.0	M
	31	8.7	Ly
	31	8.4	G
8	1	8.5	O
	3	8.6	Bl
	6	8.7	Br
	8	8.6	Bl
	12	9.0	M
	14	8.9	Ly
	14	8.7	Ma
	15	8.6	Bl
	17	8.6	Bl
	20	8.6	Ma
	23	8.8	Ly
	23	8.5	Pi
	24	8.0	M
	26	8.5	E
	27	8.7	Bl

202817
Z Delphini

8	14	12.0	Ba
	23	11.7	Ba

VARIABLE STAR OBSERVATIONS July, August and September 1914.—Continued.

202938
SZ Cygni

Mo.	Day	Est.	Obs.
6	24	9.0	R
	27	9.5	Br
	27	8.9	R
	28	9.1	R
7	2	9.5	M
	2	9.4	Ly
	3	9.5	Bu
	3	9.2	Ly
	5	9.7	Bl
	7	9.5	Ly
	8	9.5	Le
	8	9.5	Bl
	8	9.3	Ly
	8	9.4	R
	9	9.3	Le
	9	9.6	Bl
	9	9.0	Ly
	9	9.2	Br
	9	9.3	R
	10	9.8	Bu
	10	9.4	M
	10	8.9	Ly
	11	9.4	Bl
	11	8.8	Ly
	11	9.0	R
	11	9.0	Le
	12	9.2	Bl
	12	8.9	Ly
	12	9.1	R
	12	9.0	Le
	12	9.0	M
	13	9.1	R
	13	9.0	B
	13	9.2	Ly
	15	9.3	Le
	15	9.5	Bl
	15	9.4	Ly
	16	9.6	M
	16	9.5	Bl
	17	9.4	Bu
	17	9.6	Le
	17	9.6	Ly
	17	9.5	Bl
	18	9.8	Ly
	18	10.2	M
	18	9.5	Bl
	18	9.7	E
	19	9.5	Ba
	19	9.8	Le
	19	9.5	Bl
	19	10.0	P
	20	9.5	Bl
	20	9.0	R
	20	9.8	Ly
	20	9.6	Hu
	20	9.8	Le
	21	9.8	Le
	21	9.1	M
	21	9.6	Ly
	22	9.5	Bl

SZ Cygni

Mo.	Day	Est.	Obs.
7	23	9.5	Le
	23	9.0	R
	23	9.4	Ly
	24	9.3	Ly
	25	9.3	Bl
	25	9.1	Le
	25	9.0	Ly
	26	9.3	M
	26	8.9	Le
	27	9.1	Bl
	28	8.8	Ly
	28	9.0	Le
	28	9.2	Bl
	28	8.7	Ba
	29	9.1	R
	29	9.3	Bl
	29	8.9	Ba
	31	9.2	Ly
	31	9.5	Bl
8	1	9.5	R
	1	9.6	Bl
	2	9.7	M
	2	9.7	Le
	2	9.6	Ly
	3	9.7	Le
	3	9.7	Bl
	4	9.7	Ly
	6	9.6	E
	7	9.6	Le
	7	9.6	Bl
	8	9.0	R
	8	9.4	Br
	8	9.5	E
	8	9.5	Bl
	9	8.9	Ly
	9	9.0	Le
	9	9.2	Bl
	9	9.1	R
	10	8.9	Le
	10	9.4	E
	12	9.4	E
	13	9.1	R
	13	9.1	Le
	13	9.5	E
	13	9.5	Bl
	14	9.1	Ba
	14	9.5	Br
	14	9.5	M
	14	9.5	E
	14	9.3	R
	14	9.6	Bl
	15	9.5	Ly
	15	9.5	R
	15	9.5	E
	15	9.3	Ba
	15	9.6	Bl
	16	9.4	Ly
	16	9.4	Ba
	16	9.6	R
	16	9.7	Bl

SZ Cygni

Mo.	Day	Est.	Obs.
8	17	9.2	M
	17	9.5	E
	17	9.7	Bl
	17	9.4	Ly
	17	9.5	Ba
	18	9.9	R
	18	9.7	Le
	18	9.7	Ba
	18	9.9	Bl
	19	9.9	Ba
	19	9.7	Bl
	20	9.6	E
	20	10.1	R
	20	9.7	Le
	21	9.9	R
	21	9.7	Bl
	21	9.5	Le
	21	9.6	E
	22	9.6	Bl
	22	9.5	Le
	23	9.5	Hu
	23	9.4	Bl
	23	9.3	Ba
	26	9.2	R
	26	9.5	E
	27	9.5	Bl
	29	9.5	Bl
	30	9.6	Bl
	31	9.1	Ba

202954
ST Cygni

Mo.	Day	Est.	Obs.
7	21	12.5	B
	29	11.7	Hu
8	17	11.7	E
	23	11.9	Hu

203847
V Cygni

Mo.	Day	Est.	Obs.
7	3	10.0	Bu
	10	10.2	Bu
	17	10.0	Bu
	18	10.6	M
8	14	9.7	M
	18	8.9	Ba
	19	9.8	M

204405
T Aquarii

Mo.	Day	Est.	Obs.
7	21	7.7	Sp
	30	7.8	M
8	8	7.5	Bl
	14	7.8	M
	17	7.7	Sp
	19	7.7	Bl
	22	7.7	M
	23	7.7	Ly
	23	7.8	Sp
	30	7.8	Bl

205923
R Vulpeculae

Mo.	Day	Est.	Obs.
7	1	8.7	L
	2	9.1	Ly
	3	8.2	Bu
	3	9.0	M
	5	9.3	Ly
	10	8.2	Bu
	12	9.8	Ly
	13	9.7	L
	13	9.6	R
	17	8.4	Bu
	18	10.7	Ly
	19	10.8	L
	20	10.8	O
	20	9.4	R
	21	10.8	Ly
	23	10.2	R
	28	11.4	L
	28	11.3	Ly
	29	10.8	Hu
8	14	12.5	E
	23	9.8	Hu

210116
RS Capricorni

Mo.	Day	Est.	Obs.
7	3	8.7	M
8	23	8.6	Ly
	29	8.4	Bl

210129
TW Cygni

Mo.	Day	Est.	Obs.
8	21	10.5	V

210868
T Cephei

Mo.	Day	Est.	Obs.
7	2	8.4	Ly
	3	8.4	Bu
	4	8.2	Ma
	5	8.2	Ly
	5	8.5	L
	9	8.1	Ly
	9	8.0	Bl
	10	8.0	Bu
	12	8.1	Ly
	15	8.0	Ly
	16	7.0	L
	17	7.6	Bu
	17	7.7	St
	17	7.9	Ly
	18	7.7	O
	18	8.1	E
	20	7.3	L
	20	7.9	Ly
	21	8.2	M
	21	7.9	Ma
	24	7.4	O
	26	7.3	G
	26	8.0	M
	26	8.0	Ma
	28	7.7	Ly
	29	8.0	Hu

T Cephei

Mo.	Day	Est.	Obs.
7	29	6.9	Ba
	31	7.2	Ly
	31	7.3	L
8	1	7.4	O
	8	7.3	Bl
	11	6.9	L
	11	8.0	Bg
	13	7.3	Ly
	14	7.7	Bl
	15	7.3	Ma
	17	7.3	Ly
	20	8.0	M
	20	7.2	E
	20	7.1	Ma
	21	7.2	Bl
	22	7.1	O
	23	7.8	Pi
	23	7.2	Ly
	26	7.1	Ly
9	8	7.0	O

211615
T Capricorni

Mo.	Day	Est.	Obs.
7	31	11.4	L
8	12	10.3	L

213044
W Cygni

Mo.	Day	Est.	Obs.
6	28	6.3	R
	30	5.9	L
7	3	6.0	Bu
	5	5.8	L
	9	6.3	R
	10	6.0	Bu
	10	5.7	L
	11	6.5	R
	12	6.5	R
	12	6.0	G
	13	5.6	L
	13	6.3	R
	16	5.7	L
	17	6.2	Bu
	17	6.1	G
	18	5.6	L
	20	6.3	R
	21	5.5	L
	27	5.5	L
	29	6.2	R
	31	5.5	L
8	1	6.2	R
	8	6.4	R
	9	6.2	R
	10	5.4	L
	13	6.1	R
	14	6.4	R
	15	6.2	R
	16	6.3	R
	18	6.1	R
	18	5.6	L
	20	6.1	R
	21	6.2	R
	26	6.7	R

VARIABLE STAR OBSERVATIONS July, August and September 1914.—Continued.

213678
S Cephei

Mo.	Day	Est.	Obs.
7	26	10.6	M
	29	9.6	Ba
	29	10.0	Hu
8	20	10.2	M

213753
RU Cygni

Mo.	Day	Est.	Obs.
7	2	8.6	Ly
	5	8.7	Ly
	9	8.7	Ly
	9	8.7	Bl
	12	8.3	G
	13	8.6	Ly
	17	8.1	G
	17	8.6	Ly
	18	8.4	M
	21	8.5	M
	22	8.6	Bl
	23	8.7	Ly
	26	8.0	G
	29	8.5	Ly
8	2	8.3	M
	12	8.4	E
	14	8.6	Ly
	14	8.4	Bl
	16	7.9	M
	18	8.3	Bl
	23	8.7	Ly
	26	8.6	Ly
	27	8.5	Bl

213843
SS Cygni

Mo.	Day	Est.	Obs.
6	27	11.8	L
	29	11.6	L
	29	11.0	L
	30	11.5	L
7	1	10.8	Bu
	1	11.0	M
	1	11.2	M
	1	11.3	L
	2	9.1	L
	2	9.6	M
	2	9.8	Bu
	2	10.2	L
	3	8.3	G
	3	8.3	M
	3	8.1	L
	3	8.6	Ly
	3	8.6	Bu
	4	8.2	Bu
	4	8.2	M
	5	8.5	G
	5	8.5	Ly
	5	8.2	L
	5	8.4	M
	6	8.8	Ly
	7	9.2	Ly

SS Cygni

Mo.	Day	Est.	Obs.
7	7	9.1	Br
	7	8.6	M
	7	8.3	L
	8	9.3	Le
	8	9.3	Ly
	8	8.4	L
	8	8.9	Bl
	8	8.8	R
	8	9.2	E
	8	8.6	Bu
	9	9.4	Ly
	9	9.3	Le
	9	8.9	R
	9	9.5	Bl
	9	9.4	E
	9	9.3	Br
	10	9.7	G
	10	9.4	Ly
	10	9.8	M
	10	8.7	L
	10	8.6	Bu
	11	9.8	E
	11	10.1	Le
	11	10.0	M
	11	10.3	Bl
	11	9.4	R
	11	9.7	Ly
	12	10.0	Ly
	12	10.4	G
	12	10.2	Bl
	12	9.7	R
	12	10.6	M
	12	10.5	Le
	13	10.6	B
	13	10.1	R
	13	10.5	L
	13	10.9	E
	13	10.3	Ly
	14	11.2	L
	14	10.8	Bu
	14	11.2	E
	15	11.6	E
	15	11.7	Le
	16	11.4	M
	16	11.5	L
	17	11.6	Ba
	17	11.9	Le
	17	11.3	Ly
	18	11.6	J
	18	11.6	L
	18	11.3	E
	18	11.5	Ly
	19	11.6	L
	19	11.6	Le
	19	11.6	J
	19	11.5	P
	20	11.2	E
	20	11.6	Le
	20	11.5	J
	20	11.6	Ly

SS Cygni

Mo.	Day	Est.	Obs.
7	20	11.9	Hu
	21	11.6	Le
	21	11.0	M
	21	11.2	P
	21	11.3	B
	21	11.5	L
	21	11.3	E
	22	11.4	L
	23	11.7	Le
	24	11.3	E
	25	11.6	Le
	25	10.9	J
	26	10.5	Le
	26	11.4	M
	26	10.8	M
	26	10.7	O
	26	10.7	Ly
	27	11.3	L
	28	10.6	Ly
	28	11.0	Le
	28	11.3	L
	28	11.1	Ba
	28	11.1	E
	29	10.5	Ly
	29	11.2	J
	29	11.5	Ba
	29	11.0	M
	29	11.5	Pi
	29	11.9	Hu
	30	10.7	Ly
	31	11.6	J
	31	10.7	Ly
8	1	10.9	Ly
	2	11.5	M
	3	11.5	J
	4	11.5	Ly
	4	11.6	J
	5	11.5	J
	6	11.8	E
	6	12.0	M
	7	11.4	Le
	7	11.6	J
	8	11.8	Ly
	8	11.7	J
	8	11.9	E
	9	11.9	Le
10	11.9	Le	
10	11.7	E	
10	11.6	L	
12	11.5	L	
12	11.3	E	
13	10.9	Ba	
13	10.5	Ly	
13	11.0	Bl	
13	9.9	R	
13	11.1	E	
14	10.3	M	
14	8.6	M	
14	8.3	Bl	
14	8.4	Pi	

SS Cygni

Mo.	Day	Est.	Obs.
8	14	8.2	Br
	14	8.5	R
	14	8.5	E
	14	9.0	Ba
	15	8.3	Bl
	15	8.3	Pi
	15	8.3	M
	15	8.5	Ba
	15	8.5	Le
	15	8.5	Ly
	15	8.0	E
	15	8.2	R
	16	8.5	R
	16	8.2	M
	16	8.6	Ba
	16	8.6	Ly
	16	8.3	Bl
	17	8.6	Ba
	17	8.5	Ly
	17	8.3	E
	17	8.3	Le
	17	8.3	Bl
	17	7.3	M
	18	8.4	Bl
	18	8.4	Pi
	18	8.5	Ma
	18	8.6	L
	18	8.6	Ba
	18	8.9	R
	19	8.5	Ba
	19	8.5	Ly
	19	8.4	Bl
	20	8.3	E
	20	8.3	Ma
	20	8.3	Le
	20	8.5	M
	20	8.9	R
	21	8.3	Ma
	21	8.8	R
	21	8.5	Le
	21	8.6	M
	21	8.6	Sp
	21	8.4	Bl
	21	8.4	E
	21	8.4	Pi
	22	8.7	M
	22	8.5	Ly
	22	8.6	B
	22	8.3	Ma
	22	8.3	O
	22	8.3	Le
	22	8.4	Bl
	23	8.4	Ly
	23	8.4	Hu
	23	8.4	Bl
	23	8.4	Pi
	23	8.3	J
	23	8.6	Sp
	23	8.5	Ba
	23	8.8	M

SS Cygni

Mo.	Day	Est.	Obs.
8	24	8.3	E
	24	8.7	B
	24	8.7	M
	24	8.5	Sp
	24	8.5	Ly
	25	8.2	P
	25	8.9	R
	25	8.4	Pi
	26	8.4	Pi
	26	8.5	E
	26	8.7	Ma
	26	8.7	Sp
	26	8.8	M
	26	9.2	Hu
	26	8.6	Ly
	27	8.4	O
	27	8.5	E
	27	8.8	Ly
	27	9.7	Bl
	28	9.0	Ly
	29	9.6	M
	29	9.8	J
	29	10.0	Bl
	30	10.5	M
	30	10.4	Bl
	31	11.0	Ba

213937
RV Cygni

Mo.	Day	Est.	Obs.
7	2	8.0	Ly
	3	7.6	Bu
	3	8.2	M
	6	7.9	Ly
	9	7.9	Bl
	9	8.0	Ly
	10	7.0	G
	10	7.4	Bu
	14	7.2	L
	17	7.9	Ly
	17	7.6	Bu
	19	6.6	Le
	19	6.8	L
	20	6.6	Le
	20	8.0	Bl
	21	7.7	Ma
	21	6.5	Le
	23	6.5	Le
	24	8.0	E
	24	8.0	Ly
	25	6.4	Le
	26	8.0	M
	26	8.0	Ma
	26	6.4	Le
	28	6.4	Le
	29	7.2	Hu
	29	7.8	Ly
	31	7.7	Ly
8	1	7.7	Ma
	2	7.9	M
	2	6.4	Le
	3	6.4	Le

VARIABLE STAR OBSERVATIONS July, August and September 1914—Continued.

RV Cygni				RV Cygni				V Cassiop.				V Cassiop.				ST Androm.			
Mo.	Day	Est.	Obs.	Mo.	Day	Est.	Obs.	Mo.	Day	Est.	Obs.	Mo.	Day	Est.	Obs.	Mo.	Day	Est	Obs.
8	7	6.4	Le	8	24	7.5	Sp	7	17	8.0	Ba	8	28	8.7	Ly	7	19	9.4	Ba
	9	7.6	Ly		26	7.9	R		18	8.4	Bl		30	8.6	M		21	9.2	P
	9	6.5	Le		26	7.4	Sp		19	8.0	J		30	9.1	Bl		24	9.6	Ly
	10	6.5	Le		27	8.3	Bl		19	8.3	Sp	9	8	9.4	O		29	9.3	Ly
	12	6.8	L		30	7.8	M		19	8.8	P						29	9.2	Ba
	13	8.0	R						19	8.3	O		231425			8	7	9.3	Ly
	14	8.1	R						20	8.3	Ly		W Pegasi				14	9.0	Ba
	14	8.3	M		220412				20	8.4	Sp	7	18	7.9	Ly		14	9.3	Pi
	14	8.0	Bl		T Pegasi				21	8.3	Sp		24	8.0	Ly		15	9.5	Ly
	15	6.5	Le	8	26	13.2	E		22	8.4	Bl		29	8.1	Ly		16	9.4	Ly
	15	8.0	R						23	8.2	Ly	8	4	8.5	Ly		21	9.2	Pi
	15	7.2	Ma		222439				26	8.0	O		13	8.9	Ly		22	9.3	Ly
	15	7.7	Ly		S Lacertae				26	8.5	G		15	8.9	Ly		26	9.2	Hu
	16	8.0	R	8	26	12.0	E		29	7.9	Ba		19	9.3	Bl		28	9.2	Ly
	17	8.2	M						29	8.5	M		21	9.7	E		*233815*		
	17	6.6	Le		230110				29	8.1	Ly		22	9.0	V		R Aquarii		
	17	8.1	E		R Pegasi			8	9	8.2	Ly		24	9.2	Ly	8	13	6.3	Bl
	18	6.8	L	7	16	11.3	M		13	8.3	E		26	9.3	Hu		19	6.7	Bl
	18	8.2	R		18	10.5	Ly		14	8.0	Ba		28	9.5	Ly		30	6.4	Bl
	18	8.0	Bl		29	11.2	M		15	8.3	Ly		30	9.8	Bl		233956		
	20	6.6	Le	8	13	11.7	E		16	8.3	Bl		231508				Z Cassiop		
	20	8.0	R		13	9.3	Bl		17	8.6	Pi		S Pegasi			8	14	13.4	E
	21	8.1	M		15	11.0	Ly		18	8.1	Ba	7	28	8.3	E		235350		
	21	7.9	R		18	9.4	M		19	8.3	Ly	8	13	8.6	E		R Cassiop		
	21	6.6	Le		25	10.2	P		22	8.8	Pi		19	8.4	Bl	7	19	10.2	J
	21	7.5	Sp						22	8.3	O						29	8.8	M
	21	7.1	Ma		230759				22	8.4	Ly		233335						
	22	6.5	Le		V Cassiop.				23	8.5	Sp		ST Androm.			8	13	8.0	E
	23	7.2	Hu	6	20	9.3	Ly		26	8.8	Pi	7	18	10.0	Ly		235939		
	24	7.6	Ly	7	2	8.9	Ly		27	8.6	O		19	9.3	P		SV Androm.		
					16	8.2	M						19	9.5	M	7	29	12.6	Ba

July-Aug. No. of observations, 1477; No. of stars observed, 144; No. of observers, 24.
Aug.-Sept. No. of observations, 1331; No. of stars observed, 137; No. of observers, 22.

The fact that our reports are of service to others is always good news. The Secretary was recently informed that the reports are of value to spectroscopic observers at the observatory of the University of Michigan.

It might be well this coming year for some of our members to take up the work of determining the probable error or personal equation of the observers. This will serve a good purpose in any discussion of the variables. It is hoped that a number will volunteer for this useful work.

Dr. Hartwig cites the maxima of the following variables for the designated dates:

013338	Y Androm.	July 21	164317	RR Ophiuchi	Aug. 8
022813	U Ceti	" 31	164715	S Herculis	Sept. 17
032043	Y Persei	" 15	*170215*	R Ophiuchi	Aug. 22
060450	X Aurigae	" 16	171723	RS Herculis	Aug. 24
124204	RU Virginis	Aug. 9	180531	T Herculis	Sept. 9
124606	U Virginis	July 15	180565	W Draconis	Aug. 1
143227	R Bootis	Sept. 10	191537	U Lyrae	July 27
150018	RT Librae	July 29	193311	RT Aquilae	July 27
150625	Y Librae	Aug. 22	194604	X Aquilae	Aug. 1
151520	S Librae	Aug. 23	195849	Z Cygni	July 24
151822	RS Librae	July 28	200415	S Aquilae	Ang. 9
153378	S Urs. Min.	Aug. 1	201647	U Cygni	Aug. 27
155536	X Cor. Bor.	Aug. 15	203847	V Cygni	Aug. 21
161138	W Cor. Bor.	July 26	*204405*	T Aquarii	Sept. 9
163137	W Herculis	Sept. 7			

The following observers contributed to this report:—Messrs. Baldwin, Bancroft, Barbour, Bolfing, Bouton, Bruseth, Burbeck, Craig, Eaton, Gray, Hunter, Huntington, Jacobs, Lacchini, Leonard, Lindsley, Mundt, Mach, McAteer, Olcott, Pickering, Putnam, Richter, Spinney, Stepka, Vrooman, Winterbottom.*

WILLIAM TYLER OLCOTT,
Corresponding Secretary.

Norwich, Ct. Sept. 9, 1914.

COMMUNICATIONS.

The Corona—A Suggestion.—The following observations of the corona are on record.

1. That its constitution is markedly different from that of the chromosphere and the reversing layer.
2. That its material is exceedingly rarefied and thinly spaced.
3. That it is not hot.
4. That its light is largely reflected sunlight, strongly polarized (Sir John Herschel).
5. That in common with the chromosphere and the reversing layer its density does not increase downwards towards the sun's body.

Studying these findings the following suggestion is made: That the corona is composed of exceedingly minute meteoric matter which, during the quiescent term of the spot period is collected about the solar equator and is comparable to the Saturnian ring system—in the case of the sun sweeping across millions of miles. The origin of this meteoric matter probably is in part cometary and in part the sun itself, such matter being expelled by eruptive prominences. To the last Sir Robert Ball contended that the terrestrial meteors are earthborn, and, he might have added, moon born too, considering the fact that the moon has traveled from the earth's surface to its present distance. The uniform density of the corona indicates energy acting in opposition to the sun's gravitational pull and may be due to the electric activity of the sun, a view sanctioned by recent studies of spots. A further inference may be stated. If the evidence for this theory be confirmed by future observation the long-standing claim that meteoric showers falling on the sun's surface help to maintain its heat will have to be reconsidered. In such a case it would seem to be very doubtful if the sun receives any fuel supply from this source. The fact that meteoric matter is continually falling on the earth can furnish no analogy when the vast difference between the present physical condition of the sun and the earth is borne in mind.

W. E. GLANVILLE, PH. D.

St. Peters Rectory,
Solomons, Md.

* In August it was the secretary's pleasure to meet Messrs. Bouton and Spinney at Hudson, N. H., where he was delightfully entertained by the former, and had that ever agreeable opportunity of discussing variables with kindred spirits. Mr. Spinney is doing good work with a 5″ equatorial mounted in the open. Mr. Bouton has a beautiful 6″ Clarke equatorial, mounted in a convenient and well equipped observatory.

It is a pleasure to note that our members are gradually becoming acquainted with each other, and this enjoyable opportunity offered by our organization is one of its best features.

A Bright Meteor.—At Webster, Wis., 12:00 midnight, August 14, I saw a bright meteor which followed a crooked path and left a streak four or five minutes wide which was visible for about two minutes. It curved in places four or five times its width and was visible at first for 20° or more. It seems impossible that a solid body could curve so far at such a speed and it must have been electric or highly magnetized. It came from a point nearly in Perseus and crossed the tail of Delphinus and so was probably a Perseid.

A similar meteor was seen in the same neighborhood two nights before.

PAUL BABCOCK.

Huntley, Minn.

Observing Sunspots without a Telescope.—We herewith report a new method for observing sunspots without telescopic aid. If images of the sun be formed through clean-cut round holes of proper size, in a darkened room, at sufficient distance from the aperture and cast upon clean white paper or cardboard, sunspots of ordinary size may be readily seen on the image.

This method would enable amateurs to note the progress of the spots across the solar disk and if daily drawings be made the result would soon be a delightfully interesting record.

At this writing there are three spots on the sun of sufficient size to be observed in this manner, the last one of which will disappear about September 24, if it does not weaken earlier than that.

Carothers Observatory.

Houston, Texas, September 11, 1914.

GENERAL NOTES.

The Astronomical and Astrophysical Society of America held a well-attended and interesting meeting at Evanston, Ill, August 25 to 28, 1914. We are sorry not to be able to include a full report of the meeting in this number of POPULAR ASTRONOMY, but the secretary's report did not arrive until we were locking up the forms for this issue. The report will appear in the November number.

Mrs. Mary A. Albertson died on August 19, at the Nantucket Maria Mitchell Memorial where she had been librarian and curator for ten years. To her much of the success of the memorial is due. While the astronomical work and the observatory received her faithful attention, she early organized a botanical department. Having been associated with Professor Mitchell in earlier days she knew her great love for flowers and worked to collect a complete herbarium of Nantucket flora (native and introduced). It is gratifying to report that she lived to see this nearly completed. (*Science* Sept. 4, 1914).

Professor Herman Klein, of Cologne, known for his contributions to astronomy and meteorology has died at the age of seventy years.

Notes from Yerkes Observatory.—The following notes came just too late for our August-September issue.

At the Yerkes Observatory this summer *Professor F. P. Leavenworth*, of the University of Minnesota, is doing micrometric work with the 40-inch telescope. He is observing some double stars, faint comets and other objects for which a large telescope is necessary.

The following candidates for the Doctor's degree at the University of Chicago are working at the Observatory during the summer quarter:

Louis A. Hopkins, Instructor in Mathematics, University of Michigan.

Francis E. Carr, Fellow in Astronomy at University of Chicago, Instructor in Mathematics at Oberlin.

Chester H. Yeaton, recently Instructor in Mathematics at Northwestern University.

John W. Campbell, Fellow in Astronomy at University of Chicago, a recent graduate of Queen's University Kingston.

These four are specializing in celestial mechanics, but during the summer are engaged in observational work in practical astronomy and astrophysics.

Miss Jessie M. Short, recently Acting Dean of Women, Carleton College, Fellow in Astronomy at the University of Chicago, is at the Observatory for six months, chiefly making her studies in photometric work.

Mr. Harlan T. Stetson, formerly Instructor in Physics at Dartmouth, and last year Instructor in Mathematics at Northwestern University, is at the Observatory for six months, working on his thesis, which will deal with stellar photometry.

Mr. Charles A. Maney, from the University of Minnesota, computer in spectroscopy, began his work in the Observatory on July 1. He also is a candidate for the Doctor's degree in due course.

Professor F. C. Jordan, of the Allegheny Observatory, who worked at the Yerkes Observatory for several years, but was obliged to leave to take his position at Allegheny before the completion of all his work for the degree, will be examined for the Doctor's degree at the Yerkes Observatory on August 21.

Dr. John C. Duncan, of the Astronomical Laboratory at Harvard, expects to spend a part of September at the Observatory, after the Evanston meeting of the Astronomical Society.

Two other men will probably arrive at the end of the summer for a considerable period of work at the Observatory.

Mr. Harold L. Alden who has been Fellow during the past two years, goes to the McCormick Observatory at the University of Virginia as Fellow there for the coming year.

The meetings of the Journal Club at the Observatory have been resumed and are being held weekly for the discussion of live topics in physics and astronomy, with an average attendance of fifteen.

Talks, illustrated by lantern slides, are being given on Monday evenings by members of the staff on different phases of the work of the Observatory, slides being utilized from the very large collection belonging to the Observatory.

The present plan is that Professors Michelson and Gale will resume in August the observations on the rigidity of the earth, by means of the columns of water in the pipes installed in the Observatory grounds. This time the process will be automatic, interference fringes being photographed at regular intervals under the control of a clock.

It is expected that some additional work will be done in improving the grounds of the Observatory during the coming autumn.

Huggins Memorial Collection at Whitin Observatory.—By the generosity of Lady Huggins, Wellesley College Observatory has lately come into possession of certain objects of astronomical and personal interest from the collections formerly at Tulse Hill Observatory.

This memorial collection was formally presented to the college in June, in the presence of the department of Astronomy and officers at Wellesley College, and of most of the astronomers from Harvard University. The gifts were received by President Pendleton, after which Professor E. C. Pickering made an address upon the work of the Huggins, also early American contributions to photographic and spectroscopic astronomy.

The Nantucket Maria Mitchell Association is endeavoring to collect $12,000 to endow an astronomical fellowship at Harvard College Observatory. Upwards of a thousand dollars has been given for this purpose, and in addition Dr. E. C. Pickering, the director of the observatory, and Mr. Charles S. Hinchman, of Philadelphia, have each subscribed $250 for the fellowship. (*Science* Sept.4, 1914.)

Society for Practical Astronomy.—The first international conference of the Society for Practical Astronomy was held at Land's End Observatory, Port Clyde, Maine, U. S. A., 1914, August 19-21, the Conference being the guest of Mr. Russell W. Porter, of Port Clyde, and Mr. Robert H. Bowen, of Waterville, Me. The chief address of the Conference was delivered by Mr. Porter, on August 20, on the subject of "Astronomical work in the Arctic." Mr. Porter has made journeys with Peary and Cook, and was the head of the astronomical work on the second Ziegler expedition; hence he spoke from his own experiences, having been above the Circle ten times within the last twenty years, and shipwrecked three times. Mr. Horace C. Levinson, Director of the Photographic Section of the S.P.A., delivered the address on August 21, his subject being, "Astronomical Photography."

An invitation was extended, during the course of the sessions, for the Second International Conference of the S.P.A. to convene in Chicago, Ill., next summer. The exact dates of the Conference next year will be announced later.

The War and the Solar Eclipse.—No word has reached us yet as to the success or failure of the eclipse observations on August 21. The other tragedies of war are so dreadful that it might seem that the loss of observations of an eclipse should not be mentioned at a time like this, yet astronomers cannot help regretting that so many expeditions for this purpose were so summarily shut off. Many who planned to go to the eclipse path were prevented entirely. Others reached their stations before the outbreak of hostilities, but must have suffered inconvenience, if not privation and the failure of their plans, as well as hardships in returning home because of military exigencies.

Knowledge for September calls attention to two other cases where astronomical observations were hampered by war. A French astronomer, Le Gentil, was taken prisoner on his way to observe the transit of Venus of 1761, and was not released until too late. He remained in Asia to observe the transit of 1769, but his desires were frustrated by a cloud. M. Jannsen escaped by balloon from the siege of Paris, in December, 1870, to observe the eclipse of the sun in Algeria.

Lisbon's Time Signals.—Correct time is announced every even hour in the port of Lisbon, Portugal, by means of two lanterns placed on iron columns 100 feet high. The lanterns each have three faces, measuring 6.5 feet by 8 feet. At exactly five minutes before the hour, a horizontal line of light appears on each face, and on the tick of the hour, this light is extinguished. The signals may be seen even in daytime at a distance of a mile and a half. At night the positions of the lanterns is indicated by three red lights. The signals are worked electrically under the control of a clock at the Observatorio Astronomico de Lisboa. (*Scientific American* Sept. 19, 1914.)

Ninth Satellite of Jupiter.—The following telegrams from Lick Observatory, distributed by Harvard College Observatory, announce the discovery of a new satellite of Jupiter by Nicholson upon photographs taken with the Crossley reflector. It will be remembered that the eighth satellite was discovered by Melotte at Greenwich in 1908. It was also discovered by photographic means.

> 1914 July 30. Tucker telegraphs unidentified object near Jupiter. Photograph by Nicholson with Crossley Reflector. Near eighth satellite and fainter. July 21.909, Greenwich mean time, ascension $21^h\ 23^m\ 19^s.9$, south $15°\ 34'\ 38''$. July 24.921 Greenwich mean time ascension $21^h\ 22^m\ 3^s.1$, south $15°\ 41'\ 55''$.
>
> EDWARD C. PICKERING.
>
> 1914 Sept. 12. Tucker telegraphs ninth satellite of Jupiter, photographed by Nicholson July 21, confirmed by his orbit computation.
>
> EDWARD C. PICKERING

Parallax of 61 Cygni.—In a recent publication of the Königsberg Observatory Herr H. Struve gives as the result of measures of 61 Cygni from seven neighboring stars $\pi = \mathbf{0''.309} \pm 0''.013$.

Parallax of Nova Persei.—From measures made by H. Struve in 1901-1904, Dr. W. Hassenstein finds for the parallax of Nova Persei $\pi = \mathbf{0''.02} \pm 0''.03$.

Sir David Gill and Astronomical Research.—The inventory of the heritable and movable estate of Sir David Gill, K. C. B., F. R. S., L. L. D., D. Sc., of Blairythan, Foveran, Aberdeenshire, and 34, De Vere-gardens, Kensington, his late Majesty's Astronomer at the Cape of Good Hope, has been lodged with the Sheriff-Clerk of Aberdeenshire, and amounts to £23,375, on which £548 of estate duty has meantime been paid. Sir David left the Royal Astronomical Society of London the sum of £250 to be employed by the council of the society in aid of astronomical research, in grateful remembrance of the like sum paid out of the funds of the society in aid of his expedition to Ascension in 1876. He expressed the wish that the sum be devoted in whole or in part to some expenditure of a similar character, or to complete some great work, such as the computation of new tables of the satellites of Jupiter, or other like undertaking of fundamental importance to astronomy.

Publication of the American Ephemeris and Nautical Almanac for 1916.—The American Ephemeris and Nautical Almanac for the year 1916, recently issued by the U. S. Naval Observatory, differs materially in construction and arrangement from previous numbers of this publication.

The preparation of this volume marks the inauguration of the scheme of coöperation adopted by the congress of representatives of the various national Ephemerides held at Paris in 1911. In accordance with this agreement a portion of the material contained in the volume for 1916, including the greater part of the Greenwich Ephemerides of the moon and planets and the apparent places of the stars, has been supplied by the foreign almanac offices, while the office of the American Ephemeris has in turn furnished to all foreign offices the data regarding eclipses, occultations, physical ephemerides of the Sun, Moon, and planets, etc. This system of exchange reduces considerably the amount of duplication of work by different computers, and will it is believed proved mutually beneficial to the offices concerned.

Congress has, however, in the law authorizing this exchange, provided that any such arrangement shall be terminable on one year's notice and that the work of the Nautical Almanac Office during the continuance of any such arrangement shall be conducted so that, in case of emergency, the entire portion of the work intended for the use of navigators may be computed by the force employed by that office, and without any foreign coöperation whatsoever; and that employees whose services in part can be spared on this account may be employed in improving the tables of the planets, moon, and stars, to be used in preparing for publication the annual volumes.

A rearrangement of the material contained in the first part of the ephemeris has been made, with the view of giving it in better and more convenient form for the astronomer. Instead of giving portions of the ephemerides of the sun and moon alternately, month by month, there is now given for the entire year first the ephemeris of the sun complete, then the ephemeris of the moon complete, then the ephemeris of each of the seven major planets.

Other changes worthy of note are the following:—Daily ephemerides are given for 35 circumpolar stars instead of 25 and they have been arranged in more convenient form. The apparent right ascensions of stars whose declination is less than 60° are given to $0^s.001$, and the apparent declinations of all stars are given to $0''.01$. The data relative to eclipses, occultations, physical ephemerides, and satellites, are given in Greenwich time instead of Washington time. The style of type adopted permits the publication of much of the material in a more condensed form without loss of legibility.

The preparation of the material for the American Ephemeris and Nautical Almanac for 1917, on the same general lines as the volume for 1916, is now well advanced.

J. S. Hoogewerff.
Captain, U. S. Navy,
Superintendent, U. S. Naval Observatory.

Lick Observatory Publications, Volume XI.—This splendid volume contains reproductions of many of the photographs of the Milky Way and of comets which were taken by Professor E. E. Barnard at the Lick Observatory. They were taken with the six-inch Willard lens and Crocker telescope during the years 1892 to 1895. The plates, 129 in number, are by the "collo type" process, which Mr. Barnard found, after trying many other processes, to give the best results. Concerning it he

says "This process is capable of giving excellent results in the hands of an expert, but under ordinary conditions it is undesirable from the various difficulties that beset it, apparently on all sides.

As illustrating the pains which Professor Barnard has taken to secure as perfect reproductions as possible of his photographs, we may note that the work was begun in 1895-6 and that when thirty six plates had been completely printed the work was stopped because the reproductions were becoming unsatisfactory. Of these complete sets eleven were finally rejected and the work was not resumed until about fifteen years later, after trials of other processes had been made in various cities.

Many of the pictures have appeared in various astronomical journals, notably the *Astrophysical Journal*, *Knowledge*, and POPULAR ASTRONOMY, and photographs of the same regions of the Milky Way have been taken in recent years by Professor Barnard with the Bruce telescope of the Yerkes Observatory. The later photographs in many respects excel the early ones, but all astronomers will rejoice with Professor Barnard in the publication and excellent reproduction of these pioneer pictures with the star camera.

Actual Time of Signals from the U.S. Naval Observatory July, 1914.

Day	Time of signals Noon				Time of signals 10:00 p.m.			
	h	m	s		h	m	s	
1	12	0	0.03	+.03	10	0	0.00	.00
2	11	59	59.99	—.01	9	59	59.99	—.01
3	12	0	0.00	.00	9	59	59.97	—.03
4	11	59	59.99	—.01	9	59	59.99	—.01
5	12	0	0.02	+.02	9	59	59.98	—.02 Sunday
6	11	59	59.99	—.01	9	59	59.96	—.04
7	11	59	59.98	—.02	9	59	59.99	—.01
8	11	59	59.99	—.01	9	59	59.98	—.02
9	11	59	59.96	—.04	9	59	59.97	—.03
10	11	59	59.98	—.02	9	59	59.95	—.05
11	11	59	59.86	—.14	9	59	59.94	—.06
12	11	59	59.91	—.09	9	59	59.89	—.11 Sunday
13	11	59	59.90	—.10	9	59	59.87	—.13
14	11	59	59.86	—.14	9	59	59.82	—.18
15	11	59	59.80	—.20	10	0	0.00	.00
16	11	59	59.97	—.03	10	0	0.00	.00
17	12	0	0.02	+.02	10	0	0.03	+.03
18	12	0	0.01	+.01	10	0	0.01	+.01
19	12	0	0.02	+.02	10	0	0.04	+.04 Sunday
20	12	0	0.03	+.03	10	0	0.02	+.02
21	12	0	0.02	+.02	10	0	0.02	+.02
22	12	0	0.03	+.03	9	59	59.96	—.04
23	11	59	59.96	—.04	9	59	59.98	—.02
24	11	59	59.95	—.05	9	59	59.97	—.03
25	11	59	59.95	—.05	9	59	59.96	—.04
26	11	59	59.92	—.08	9	59	59.96	—.04 Sunday
27	11	59	59.93	—.07	9	59	59.95	—.05
28	11	59	59.94	—.06	9	59	59.97	—.03
29	11	59	59.98	—.02	9	59	59.98	—.02
30	11	59	59.97	—.03	9	59	59.94	—.06 * Estimated
31	11	59	59.92	—.08	9	59	59.93	—.07

Maximum error July 15th —.20

(+) slow
(—) fast

J. A. HOOGEWERFF,
Captain U.S. Navy
Superintendent.

U.S. Naval Observatory,
Washington, D. C.
August 5, 1914.

The Constitution of the Atom.—*Science* for August 21, 1914 gives the following account, quoted from the London *Times*, of a talk by Professor J. J. Thomson to the Physical Society of London, at a meeting in the Cavendish Laboratory, June 20, concerning some important experiments he has been making with regard to the production of very soft Röntgen radiation by the impact of positive and slow cathode rays.

Professor Thomson said he proposed to give them an account of some recent experiments whose object was to fill up a gap in the kind of radiation that they had at their disposal upon investigation of the properties of the atom. The study of Röntgen radiation had enabled them to prove the existence of two separate rings of electrons, one inside the other; the one was responsible for what is known, as the K kind of radiation, and the other had the L characteristic, but the L characteristic was so much softer than the K that, if they were to consider what would be likely to be the properties of the radiation given out by a third ring, if the rate of increase in softness was anything like the same proportion, the radiation from the third ring would come well within that region of radiation which at present had not been studied, and if they command a continuous series of radiations, extending from the visible light which affected the outer ring of electrons right up to the hardest region of radiation, they would be able to see how many separate vibrating systems, how many rings of electrons there were inside the other, and, more than that, they would be able, by the study of that radiation, to gauge the number of electrons in each ring, so that this study promised to give them the means of determining the distribution of electrons throughout the atom. In the experiments two methods had been employed. The first was the production of Röntgen radiation by the impact of positively charged atoms. By availing himself of the very remarkable sensitiveness of the Schuman photographic plate they had been enabled to get unmistakable evidence that as the positive rays impinged against a surface they gave out a type of Röntgen radiation. Professor Thomson described at length the apparatus he employed, which in this case was a Crookes tube, and the experiments he made. His second method was by the impact of cathode rays, and they arranged the experiment so that they had the speed of the cathode rays very much under control. In this experiment an ordinary Röntgen ray tube was employed. The photographic method, Professor Thomson continued, was rather time wasting, and they had lately tried experimenting with a substitute for the photographic plate, and if they succeeded with those experiments they probably would be able to get on much more quickly. But even with the photographic plate they hoped to make a series of experiments which would enable them to find how many rings of electrons there were in an atom.

CASSIOPEIA.

O storied queen, who on the starry way
That girds the welkin with its hazy zone
Hast firmly stablished thy resplendent throne
Where Tycho's star erst glowed with transient ray;
Immortal now, thou once wast mortal clay,
And well a mother's poignant grief hast known;
But now thy woes are fled, thy sorrows flown;
Thy loved ones round thee all thy pangs allay.
Thy husband Cepheus wears his astral crown
Nigh thee; Andromeda, thy daughter sweet,
Decked with her nebulous girdle, sparkles fair;
Her lover Perseus, bent on swooping down
Against her orc, poised on wingèd feet.
All these in love assemble near thy chair.

WARREN H. CUDWORTH.

Norwood, Mass.

Publications Received.

Observatoire de la Société astronomique de France; Observations et travaux, Vol. II, 1912-13.

Observatoire d'Alger, Catalogue photographique du ciel, Tome V, zone $-1°$ à $+1°$, deuxième fascicule: de $7^h\ 4^m$ à $23^h\ 52^m$, Paris 1913. Tome VII, Zone $-3°$ à $-1°$, deuxième fascicule: de $6^h\ 8^m$ à $2\ 3^h\ 52^m$. Tome VI, Zone $-2°$ à $+0°$, troisième fascicule; préambule.

Observatorio Astronomico de la Universidad Nacional de La Plata. Publicaciones, Tomo 1, Descripción general del Observatorio, su posición geográfica, y observaciones de cometas y de estrellas dobles.

Lunar Nomenclature Committee of the International Association of Academies. Collated list of lunar formations named or lettered in the maps of Neison, Schmidt, and Mädler, compiled and annoted for the Committee by Mary A. Blagg under the direction of the late S. A. Saunder, Edinburgh, 1913.

Turner, H. H., Tables for facilitating the use of harmonic analysis, as arranged by, London 1913.

Struve, H., Bestimmung der Parallaxe von 61 Cygni aus Deklinations differenzen gegen sieben benachbarte Sterne.

Hassenstein, Dr.W., Messungsreihe der Nova Persei, von H. Struve in den Jahren 1901-1904, diskutiert von.

Dominion Observatory, Ottawa, Publications, Vol. 1, No. 6, The Spectrum of Nova Geminorum, by J. S. Plaskett. No. 7. Experiments regarding efficiency of Spectrographs by J. S. Plaskett. No. 8. Precise Levelling by F. B. Reid.

Strömgren, E., und Bj. Drachmann, Ueber die Verteilung der Sterne in kugelförmigen Sternhaufen, mit besonderer Rücksicht auf Messier 5.

Strömgren, E., Ueber den Ursprung der Kometen.

Observatoire d'Abbadia. Observations, Tome XII, Observations faites au circle méridien en 1912.

Rapports sur les observatoires astronomiques de province, année 1913.

King, Arthur S., A vertical adaptation of the Rowland mounting for a grating. Some electric furnace experiments on the emission of enhanced lines in a hydrogen atmosphere. Contrib. Mount Wilson Solar Observatory Nos. 83, 85.

Kapteyn J. C., On the individual parallaxes of the brighter Galactic helium stars in the southern hemisphere, together with considerations on the parallax of stars in general. Contrib. Mount Wilson Solar Observatory No. 82.

Kapteyn, J. C., On the change of spectrum and color index with distance and absolute brightness. Contrib. Mount Wilson Solar Observatory No. 83.

Solar Physics Observatory, University of Cambridge, First annual Report of the director to the Solar Physics Committee, 1913 April 1-1913 March 31.

Astronomical Society of the Pacific, Publications. A general index to Volumes I to XXV (1889-1913.)

Observatoire d'Alger, Catalogue photographique du ciel, Tables pour la transformation des coördonnées rectilignes en coördonnées sphériques, établies par M. Pourteau. Appendice au tome IV.

Observatoire d'Abbadia, Tables pour le calcul de la précession en A. R. et D., èquinoxe de 1900, Hendaye (B. P.), 1913.

Annals of the Observatory of Harvard College, Vol. LXIX, Part II. Photometric observations made with the fifteen-inch east equatorial during the years 1903 to 1912 by Oliver C. Wendell.

Annals of the Observatory of Harvard College, Vol. LXXIII, Part I. Observations and investigations made at the Blue Hill Meteorological Observatory, in the years 1909 and 1910 under the direction of A. Lawrence Rotch.